

August 31, 2012

PROJECT MANUAL

Set Number

NORTHERN KENTUCKY UNIVERSITY

INTRAMURAL FIELDS & SUPPORT BUILDING

HIGHLAND HEIGHTS, KENTUCKY

Omni Project No. 1119.01



Omni Architects

212 North Upper Street, Lexington, Ky 40507-1001

p 859.252.6664

BFMJ, INC., STRUCTURAL ENGINEERS

620 East Euclid Ave., Suite 300, Lexington, KY 40502 , p.859.278.5050

CMTA Consulting Engineers, MEP ENGINEERS

10411 Meeting Street, Prospect, Kentucky 40059, p.502.326.3085

VIVIAN LLAMBI & ASSOCIATES (DBE), LANDSCAPE ARCHITECTS / CIVIL ENGINEER

2312 Park Avenue, Cincinnati, OH 45206, p.513.559.9444

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

Contents

Contract Document	# of Pages
LIST OF PROPOSED SUBCONTRACTORS	3
LIST OF MATERIALS AND EQUIPMENT	3
LIST OF UNIT PRICES	2
AFFIDAVIT OF ASSURANCE	2
ALLOWANCE FORM	1
PERMIT APPLICATIONS	1
GEOTECHNICAL REPORT	11
TECHNICAL SPECIFICATIONS FOR BIDDERS (INCLUDING INDEX)	497
ADDENDA	(ISSUED AS REQUIRED)

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
LIST OF PROPOSED SUBCONTRACTORS
(Must be submitted with bid)

LIST OF SUBCONTRACTORS. The following list of proposed subcontractors is required by the owner to be executed, completed, and submitted with the Bid. All subcontractors are subject to approval by Northern Kentucky University (NKU). Failure to submit this list, completely filled out, will result in a bid rejection. **SUBCONTRACTORS MAY NOT BE CHANGED AFTER CONTRACT AWARD WITHOUT APPROVAL BY NKU.**

If certain branches of work are to be done by the Prime Contractor, so state. Review/evaluation of subcontractors will occur on the bid opening day. If NKU requests replacement of a subcontractor on bid opening day, then the apparent low bidder will provide a replacement subcontractor prior to close of NKU's business day on that day. Failure of the apparent low bidder to comply with the preceding sentence will result in bid rejection. If subcontractor review/evaluation is not completed on the bid opening day, then procedures for any replacement will be issued based on the uniqueness of each situation. The responsibility for selection of qualified, competent subcontractors to accomplish the work intended is solely the responsibility of the bidder.

<u>BRANCH OF WORK</u>	<u>NAME, ADDRESS AND TELEPHONE OF SUBCONTRACTORS</u>
-----------------------	--

SITework

Earthwork	
Site Concrete	
Field Turf Base Installer	
Field Turf Installer	
Fencing	
Segmental Wall	
Asphalt	

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

Landscape – Seed and Straw

Sewer Pipe Installer (Site Plumbing)

STRUCTURAL

Concrete Finisher

Concrete/Masonry Reinforcing Installer

Soil Testing

Concrete/Grout Testing

ARCHITECTURAL

Masonry

Roofing

Carpentry

MECHANICAL/ELECTRICAL

Mechanical

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

Plumbing

Sheet Metal

Electrical

END OF LIST OF PROPOSED SUBCONTRACTORS

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
LIST OF MATERIALS AND EQUIPMENT

Every item listed must be clearly identified so that the Owner will know what the Bidder proposes to furnish. Failure to submit a proper list may result in rejection of the Bidder's Proposal.

The use of the manufacturer or dealer name only, or stating "as per plans and specifications", will not be considered as sufficient identification. No material or equipment will be considered which is not in every respect equal to that specified. or shown on the drawings.

Item Description	Brand Name	Manufacturer
SITWORK		
1. Pipe		
2. Synthetic Field Turf		
3. Infill Materials for Field Turf		
4. Aggregate Base for Field		
5. Field Drain Lines		
6. Concrete / Rebar / Joint Materials		
7. Chainlink Fencing and Gates		
8. Nylon Sports Netting		
9. 2x12 Backstop Lumber		
11. Segmental Wall Units		
12. Seed & Straw – disturbed areas		
13. Asphalt & Base		
14. ADA Truncated Domes at Ramp		

STRUCTURAL

15. Concrete Batch Plant		
16. Grout		

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

- 17. Concrete Reinforcement _____
- 18. Wood Trusses _____

ARCHITECTURAL

- 19. Decorative CMU _____
- 20. Asphalt Shingles _____
- 21. Hollow Metal Doors & Frames _____
- 22. Coiling Counter Doors _____
- 23. Sectional Doors _____
- 24. Hardware - Locksets _____
- 25. Hardware - Closers _____
- 26. Hardware - Hinges _____
- 27. Visual Display Surfaces _____
- 27. Paint _____

MECHANICAL / ELECTRICAL

- 28. Plumbing Fixtures _____
(Water Closets, Urinals, & Lavatories)
- 29. Plumbing Accessories (Faucets) _____
- 30. Plumbing – Flush Valves _____
- 31. Domestic Water Heaters _____
- 32. Louvers _____
- 33. Dry-Type Transformers _____
- 34. Disconnect Switches _____
- 35. Telephone / Data Equipment _____

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

- 36. Chemical Grounding System _____

- 37. Sprinkler Heads / Equipment _____

- 38. Panelboards _____

- 39. Wiring Devices _____

- 40. Lighting Fixture Types: Attach list _____

- 41. Sports Lighting Manufacture _____

Include cut sheets, installation instructions and operational instructions as an attachment to the end of the form of proposal.

Signed By: _____

Company Name: _____

Date: _____

END OF LIST OF MATERIALS AND EQUIPMENT

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
LIST OF UNIT PRICES

Unit prices shall include the furnishing of all labor, materials, suppliers, services, and shall include all items of cost, overhead and profit for the Contractor and any Subcontractor involved, and shall be used uniformly without modification for either additions or deductions. The Unit Prices as established shall be used to determine the equitable adjustment of the Contract Price in connection with changes or extra work performed under the Contract (both additions and subtractions). Failure to completely fill out all unit prices requested will result in bid rejection.

ITEM DESCRIPTION	UNIT	UNIT PRICE
SITWORK		
1. Storm Sewer Pipe, 6"	L.F.	\$ _____
2. Storm Sewer Pipe, 12"	L.F.	\$ _____
3. Storm Sewer Pipe, 15"	L.F.	\$ _____
4. Storm Sewer Pipe, 24"	L.F.	\$ _____
5. Forcemain, 3"	L.F.	\$ _____
6. Catch Basin	EA	\$ _____
7. Manhole	EA	\$ _____
8. Headwall	EA	\$ _____
9. Excavation/Earthwork	C.Y.	\$ _____
10. Synthetic Turf	S.F.	\$ _____
11. Synthetic Turf Infill Material	C.Y.	\$ _____
12. Aggregate Base for Fields	C.Y.	\$ _____
13. Drainlines under Field	L.F.	\$ _____
14. Site Concrete	C.Y.	\$ _____
15. Concrete Retaining Wall & Foundation	S.F. of wall	\$ _____
16. Segmental Retaining Wall & Foundation	S.F. of wall	\$ _____
17. 8' ht Vinyl Coated Chainlink Fence	L.F.	\$ _____
18. 14' Sports Netting	L.F.	\$ _____
19. Softball Backstop	LUMP SUM	\$ _____
20. Asphalt & Base	C.Y.	\$ _____
21. Seed & Straw	S.F.	\$ _____

STRUCTURAL

(Not Applicable)

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

ARCHITECTURAL

22. 3' x 7' Hollow Metal Door #1, Frame & Hardware Set #1, Painted EA \$ _____

MECHANICAL AND ELECTRICAL

23. ½" Insulated Copper Water Line installed L.F. \$ _____

24. ¾" Copper Water Line installed under grade including trenching and backfill L.F. \$ _____

25. ½" Ball Valve installed in piping L.F. \$ _____

26. 2" PVC Conduit installed underground L.F. \$ _____

27. Duplex Convenience Outlet installed complete with 50 ft. of ¾" conduit and 3#12 EA \$ _____

28. GFI Duplex Convenience Outlet installed complete with 50 ft. of ¾" conduit and 3#12 EA \$ _____

29. Data Outlet Rough-in installed complete with 50 ft of ¾" conduit and pull string EA \$ _____

30. Exit Light installed complete with 50 ft. of ¾" conduit with 3#12 EA \$ _____

31. 120V, 15A Duplex Outlet EA \$ _____

32. 120V, 20A Duplex Outlet EA \$ _____

33. 120V, 20A Ground Fault Outlet EA \$ _____

34. 120V, 20A Floor Outlet EA \$ _____

35. Quadraplex Outlet installed complete with 50 ft. of ¾" conduit and 3#12 EA \$ _____

36. Quadraplex Outlet with Surge Protection installed complete with 50 ft. of ¾" conduit and 3#12 EA \$ _____

37. Single Pole Light Switch EA \$ _____

38. Conduit (¾") L.F. \$ _____

39. Conduit (1") L.F. \$ _____

40. 2, #12 Type THWN Conductor L.F. \$ _____

41. 3, #12 Type THWN Conductor L.F. \$ _____

42. 2, #10 Type THWN Conductor L.F. \$ _____

43. 3, #10 Type THWN Conductor L.F. \$ _____

END OF LIST OF UNIT PRICES

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
AFFIDAVIT OF ASSURANCE

The General Contractor shall be required to complete the attached affidavit of assurances and to submit prior to beginning work to the Kentucky Department of Housing, Buildings and Construction at "Award of Contract":

The Kentucky Department of Housing, Buildings and Construction
Division of Building Codes Enforcement
101 Sea Hero Road, Suite 100
Frankfort, Kentucky 40601
502-573-0373

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building

When submitting plan for a construction permit, the Affidavit of Assurances Form, as shown below, shall be submitted with plans to the Building Code Official. No form other than the one shown below shall be accepted.

DOH-BCE-04 _____ 7/90

CASE NO. _____

PROJECT NAME: _____

CITY/COUNTY: _____

* AFFIDAVIT OF ASSURANCES
PURSUANT TO KRS 198B.060(10)

Comes to the Applicant, _____ and states,
(print name)
pursuant to KRS 198B.060(10), that all contractors and subcontractors employed or that will be employed on any activity under the above project shall be in compliance with the Commonwealth of Kentucky requirements for Workers' Compensation Insurance (according to KRS Chapter 342) and Unemployment insurance (according to KRS Chapter 341).

THIS the _____ day of _____, 200_____.

CONTRACTOR, OWNER OR OWNER'S AGENT

SUBSCRIBED AND SWORN to before me by _____, Applicant, on this the _____
day of _____, 200_____.

NOTARY PUBLIC
STATE AT LARGE

MY COMMISSION EXPIRES: _____

* [] The Affidavit of Assurances is not required because the local building code official was, or will be presented the assurances upon issuance o the local building permit.

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
ALLOWANCE FORM

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Project Name: Intramural Fields and Support Building
- C. Project Location: Highland Heights, Kentucky
- D. Owner: Northern Kentucky University
- E. Architect: Omni Architects
- F. Architect Project Number: 1119.01

1.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.
- B. The undersigned Bidder certifies that Base Bid submission to which this Bid Supplement is attached includes those allowances described in the Contract Documents and scheduled in Section 012100 "Allowances."

1.3 SUBMISSION OF BID SUPPLEMENT

- A. Respectfully submitted this ____ day of _____, 2012.
- B. Submitted By: _____(Insert name of bidding firm or corporation).
- C. Authorized Signature: _____(Handwritten signature).
- D. Signed By: _____(Type or print name).
- E. Title: _____(Owner/Partner/President/Vice President).

END OF ALLOWANCES

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
PERMIT APPLICATIONS

The following documents indicate the status of permit applications for the NKU Intramural Fields and Support Building project.

Listing:	Pages
1. Relocation of Duke Energy overhead power line and easement	Required By Owner
2. Electrical (Duke Energy)	Required By Contractor
3. Sanitary Line - Sanitary District 1 (SD-1)	Required By Contractor
4. Storm Water – Sanitary District 1 (SD-1)	Required By Contractor

Northern Kentucky University’s construction activity is reviewed by the Commonwealth of Kentucky Department for Housing, Buildings, & Construction with regards to all building code enforcement, building plan review/approval during design, and building inspections during construction. Local building permits are not required and university property is exempt from compliance with local zoning regulations. During construction, the assigned state building inspector is considered the fire marshal until the Certificate of Occupancy is issued. At that time, the building is then referred to the state fire marshal’s control. As of Spring 2012, the following state inspectors are assigned to all construction projects at NKU:

State Building Inspector:
Bill Amato
(606) 538-0566
william.amato@ky.gov

State Electrical Inspector:
Ken Leathers
(502) 573-1797
ken.leathers@ky.gov

State Plumbing Inspector:
Don Miller
John “Tom” Boone
johnt.boone@ky.gov

NORTHERN KENTUCKY UNIVERSITY
Intramural Fields & Support Building
GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. Soil-boring data for Project, obtained by Alt and Witzig Engineering, Inc., dated April 9, 2012, is available for viewing as appended to this Document.
- C. A geotechnical investigation is appended to this Document.
- D. Related Requirements:
 - 1. "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.



Alt & Witzig Engineering, Inc.

6205 Schumacher Park Drive • West Chester, Ohio 45069

Phone: (513) 777-9890 • www.altwitzig.com

April 9, 2012

Northern Kentucky University, Inc.
726 Lucas Administrative Center
Highland Heights, Kentucky 41099
ATTN: Mr. Rob Knarr, P.E.

RE: Subsurface Investigation &
Foundation Recommendations
Northern Kentucky University
Intramural Fields Reconstruction
Highland Heights, Kentucky
Alt & Witzig File: 12CN0043

Gentlemen:

In accordance with your authorization, we have completed soil borings in the area of the proposed Intramural Fields Reconstruction. The purpose of this subsurface investigation was to determine the various soils profile components, the engineering characteristics of the subsurface materials and to provide information for use with improvements to be considered with the existing athletic fields.

Field Services

Field investigations to determine the engineering characteristics of the foundation materials included a reconnaissance of the project site and drilling two (2) borings. Standard penetration tests with soil samples retained in the standard split-spoon sampler were also performed during drilling operations. The apparent groundwater level at each boring location was also determined.

The soil borings were performed with a conventional drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Representative samples were obtained employing split-spoon sampling procedures in accordance with ASTM Procedure D-1586.

During the sampling procedure, standard penetration tests were performed at regular intervals to obtain the standard penetration value of the soil. The standard penetration value is defined as the number of blows of a 140-pound hammer, falling thirty (30) inches, required to advance the split-spoon sampler one (1) foot into the soil. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Laboratory Testing

The types of soils encountered in the borings were visually classified and are described in detail on the boring logs. Representative samples of the soils encountered in the field were placed in sample jars and are now stored in our laboratory. Unless notified to the contrary, all samples will be disposed of after thirty (30) days.

Project Description

It is anticipated that the proposed construction will consist of the reconstruction of the turf field and the construction of a single-story support building. The support building will be a 2,000 s.f. lightly loaded structure. Proposed grading for the field has not been provided to us, however, it is anticipated that the turf field and structure will be constructed at or slightly above existing site grades.

Subsurface Discussions

The borings encountered fill consisting of reworked shale mixed with clay and some limestone fragments to a depth of eighteen (18) feet below grade. At this depth possible fill soils having a medium stiff consistency was encountered to the termination depth of our borings at twenty (20) feet below grade. The borings indicated dry conditions during and upon completion of operations and were backfilled prior to leaving the site. The fill appeared to have a medium stiff consistency with moisture contents ranging from 11.4% to 18.9%. This would seem to indicate that the fill was placed in a controlled manner, however, construction testing for this fill was not provided to us. If construction testing and monitoring of the fill was performed, please provide reports to AWEI for review and consideration of these recommendations.

Foundation Recommendations

Due to the presence of undocumented fills construction on these soils carries some risks. These include possible differential settlement of the structure which could cause cracking in the walls and floor slab and doors and windows which do not close properly. To minimize these risks a low bearing pressure and designing the structure for some future movement would be recommended. Also, using wood frame or a pre-engineered structure with concrete foundations would be strongly recommended. If these risks are not acceptable to the owner use of deep foundations or ground modification would be required. Further discussion of these foundation types can be presented to the owner if requested, however, it will be necessary to extend the holes to bedrock and perform a minimum of one rock core if this foundation type will be used. Conventional shallow foundations are presented in this report.

Shallow Spread Footings A net allowable soil bearing pressure of 1500 psf is recommended to design conventional spread footings and continuous wall footings. The above-recommended bearing pressure assumes the footings will be founded within the existing fill soils and that the owner is willing to accept that differential settlement could occur.

To reduce the impact differential settlement could have, we suggest the addition of reinforcement into the foundation. It is suggested that a minimum of four (4) no. 5 rebar be added to the foundation. Also, it is recommended that footings should not be less than thirty (30) inches wide for walls or thirty-six (36) inches square for columns. However, minimum-footing sizes and reinforcement requirements must also be in compliance with the actual building loads and all local

building code requirements. Thus, the foundation designer may decide that larger foundations or additional reinforcement will be required.

The above recommended bearing pressure is a "net allowable soil pressure". In utilizing the net allowable pressure for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevations.

In order to alleviate the effects of seasonal variation in moisture content on the behavior of the footings and eliminate the effects of frost action, all foundations in unheated areas should be founded a minimum of thirty (30) inches or greater below the final grade.

Floor Slab

The ground floor for the building can be constructed as a slab-on-grade supported by the existing soils. However, it should be noted that undocumented fill would remain in the floor slab area. It is recommended that a proofroll inspection be observed by a representative of AWEI. Areas that fail this proofroll must be stabilized using geogrid, geogrid/stone, or chemical stabilization, or undercut and replaced with suitable soils. The exact method of repair will depend on the soils encountered and should be determined by the soil engineer, owner, and contractor at the time of the proofroll. These measures will minimize risks to the owner. However, cosmetic failures (some cracking, etc...) could occur and additional future maintenance will most likely be required. If the risk of cosmetic failures or increased maintenance is not acceptable it is recommended that the floor slab be constructed as a structural slab or the fills be removed from the building area.

After the building area has been prepared to the proper elevation, a four (4) to six (6) inch compacted granular fill should be placed immediately beneath the floor slab. This compacted granular fill will provide a uniform surface for construction of the slab and minimize capillary rise of groundwater from the subgrade into the slab.

Seismic Requirements

Seismic design consideration based on the information obtained in our subsurface investigation and the Kentucky Building Code guidelines indicates that the site will be classified with a site class C.

Turf Field Reconstruction

Conditions in our borings were fairly consistent. As mentioned, fill was encountered across the area. In addition eight (8) to nine (9) inches of topsoil was noted with our borings. No groundwater was encountered with our investigation.

With respect to construction, provided that the surface is not saturated at the start of construction and light tracked equipment is used to strip the topsoil, the subgrade should be sufficient to place the new field. However, due to instability caused by the existing fills stabilization by means of either undercutting and replacing or installation of a geogrid and stone section to bridge the material could

be required. The actual method to be used should be determined in the field based on the extent of any soft or yielding areas encountered during the proofroll evaluation of the subgrade prior to placement of any new fill or the turf.

For the field, the proofroll phase should be performed after the surface has been stripped. A moderately loaded dump truck (minimum GVW of 35,000-lbs) should be used to evaluate the subgrade condition before any new fill or the turf is placed. Manufacturer's specifications should be followed for construction of the field to support the turf but we suggest at least 5-inches of sand and gravel below the turf to allow for grading and drainage. The fields should include positive drainage away from playing surface (typically no less than 1%). We are not aware if the field has a system of underdrains to enhance drainage across the fields. Underdrains would improve drainage across the field, especially due to the very flat nature of the grading required to construct the playing surface. We suggest underdrains be considered if there are none present.

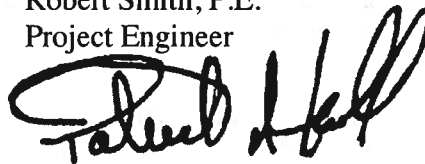
If there are questions concerning these matters, please feel free to contact our office.

Respectfully Submitted,

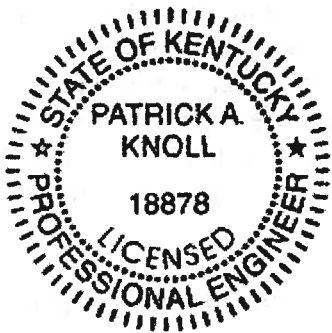
ALT & WITZIG ENGINEERING, INC.



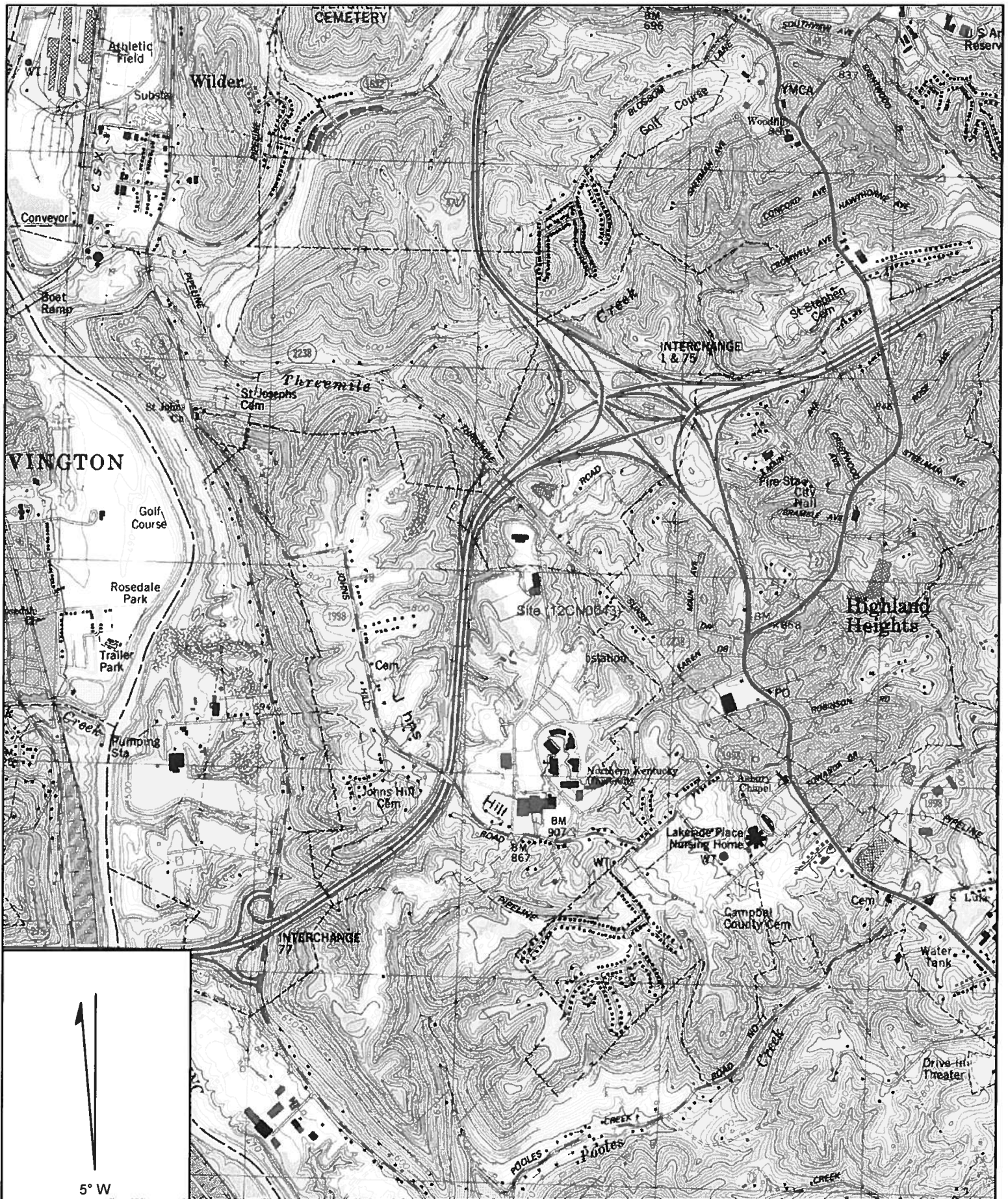
Robert Smith, P.E.
Project Engineer



Patrick A. Knoll, P.E.



APPENDIX



Name: NEWPORT
 Date: 3/30/2012
 Scale: 1 inch equals 2000 feet

Location: 039° 02' 17.0" N 084° 28' 04.5" W
 Caption: Site Location Map 12CN0043
 NKU Intramural Fields Reconstruction
 Highland Heights, Kentucky

**BORING
LOCATION
PLAN**

Intramural Fields Reconstruction
Northern Kentucky University
Highland Heights, Kentucky

3-01-1

**OPERATION
MAINTENANCE**

*APPROXIMATE
NEW BORING
LOCATIONS*

**PROPOSED
SURVEY
BOUNDARY
LIMIT**

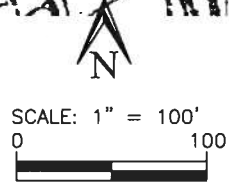


B-1

B-2

BASKETBALL

STUDENT PA



SCALE: 1" = 100'

12CN0043



RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT Northern Kentucky University
 PROJECT NAME Intramural Fields Re-Construction
 PROJECT LOCATION Highland Hieghts, KY

BORING # B-1
 Alt & Witzig File No. 12CN0043

DRILLING and SAMPLING INFORMATION

Date Started 3/29/12 Hammer Wt. 140 lbs.
 Date Completed 3/29/12 Hammer Drop 30 in.
 Boring Method HSA Spoon Sampler OD 2 in.
 Driller J.Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Unit Weight (pcf)	Remarks
	SURFACE ELEVATION											
	TOPSOIL	0.8		1	SS	[Symbol]		19		3.0	14.9	
	Brown and Gray CLAY with Shale and Some Limestone Fragments (Fill)	5		2	SS	[Symbol]		8		2.0	16.9	
		7.0		3	SS	[Symbol]		36		4.5	11.4	
	Gray Shale and Brown CLAY Some Limestone Fragments (Fill)	10		4	SS	[Symbol]		14		2.5	15.2	
		15		5	SS	[Symbol]		30		4.0	14.2	
	Gray Highly Weathered Shale (Possible Fill)	18.0		6	SS	[Symbol]		19		4.5		
	End of Boring at 21 feet	21.0										

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Groundwater
 ○ During Drilling Dry ft.
 ∇ At Completion Dry ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 DC - Driving Casing
 MD - Mud Drilling



RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT Northern Kentucky University
 PROJECT NAME Intramural Fields Re-Construction
 PROJECT LOCATION Highland Hieghts, KY

BORING # B-2
 Alt & Witzig File No. 12CN0043

DRILLING and SAMPLING INFORMATION

Date Started 3/29/12 Hammer Wt. 140 lbs.
 Date Completed 3/29/12 Hammer Drop 30 in.
 Boring Method HSA Spoon Sampler OD 2 in.
 Driller J.Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Unit Weight (pcf)	Remarks	
	SURFACE ELEVATION												
	TOPSOIL	0.9		1	SS	[Symbol]		26		4.3	15.2	LL=37% PL=22% PI=15%	
	Brown and Gray CLAY with Shale and Limestone Fragments (Fill)		5	2	SS	[Symbol]		15		4.5	12.6		
				3	SS	[Symbol]		11		3.0	18.9		
			10		4	SS	[Symbol]		12		3.0		15.7
			15		5	SS	[Symbol]		37		3.5		14.3
	Brownish Gray CLAY and Limestone (Possible Natural)	18.0		20	6	SS	[Symbol]	50/3		3.5	11.5		
	End of Boring at 21 feet	21.0											

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Groundwater

- During Drilling Dry ft.
- ∇ At Completion Dry ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

- N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.
- Qu: Unconfined compressive strength, TSF
- Qp: Penetrometer value, unconfined compressive strength, TSF
- Mc: Water content, %
- LL: Liquid limit, %
- PL: Plastic limit, %
- Dd: Natural dry density, PCF
- : Apparent groundwater level at time noted after completion

DRILLING AND SAMPLING SYMBOLS

- SS: Split-spoon - 1 3/8" I.D., 2" O.D., except where noted
- ST: Shelby tube - 3" O.D., except where noted
- AU: Auger sample
- DB: Diamond bit
- CB: Carbide bit
- WS: Washed sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

<u>TERM (NON-COHESIVE SOILS)</u>	<u>BLOWS PER FOOT</u>
Very loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	Over 50

<u>TERM (COHESIVE SOILS)</u>	<u>Qu (TSF)</u>
Very soft	0 - 0.25
Soft	0.25 - 0.50
Medium	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.(+)	Coarse Sand	5 mm-0.6 mm	Silt	0.075 mm - 0.005 mm
Cobbles	8 in. - 3 in.	Medium Sand	0.6mm-0.2 mm	Clay	0.005mm(-)
Gravel	3 in. - 5 mm	Fine Sand	0.2mm-0.075 mm		

INDEX TO SPECIFICATIONS

SECTION	PAGES
DIVISION 1 - GENERAL REQUIREMENTS	
011100 Summary	4
012100 Allowances	2
012200 Unit Prices	1
012300 Alternates	1
012500 Substitution Procedures	3
012600 Contract Modification Procedures	2
012900 Payment Procedures	4
013100 Project Management and Coordination	6
013200 Construction Progress Documentation	7
013300 Submittal Procedures	7
014000 Quality Requirements	5
014110 Structural Test and Special Inspections	6
014200 References	6
015000 Temporary Facilities and Controls	7
016000 Product Requirements	3
017300 Execution	6
017419 Construction Waste Management and Disposal	1
017700 Closeout Procedures	4
017823 Operation and Maintenance Data	7
017839 Project Record Documents	3
017900 Demonstration and Training	4
DIVISION 2- EXISTING CONDITIONS	
024119 Selective Demolition	3
DIVISION 3- CONCRETE	
033000 Cast-in-Place Concrete	17
033300 Architectural Concrete	4
DIVISION 4- MASONRY	
042100 Reinforced Unit Masonry	17
042200 Concrete Unit Masonry	8
DIVISION 5- METALS	
050020 Adhesive (Chemical) Anchors and Expansion Anchors	3
055000 Metal Fabrications	7
DIVISION 6- WOOD, PLASTICS, AND COMPOSITES	
061000 Rough Carpentry	7
061753 Prefabricated Dimensional Wood Trusses	4
DIVISION 7- THERMAL AND MOISTURE PROTECTION	
071113 Bituminous Damproofing	3
072100 Thermal Insulation	3
073113 Asphalt Shingles	6

074600	Siding	3
076200	Sheet Metal Flashing and Trim	5
077100	Roof Specialties	5
079200	Joint Sealants	7

DIVISION 8- OPENINGS

081113	Hollow Metal Doors and Frames	6
083113	Access Doors and Frames	3
083313	Coiling Counter Doors	5
083613	Sectional Doors	6
087100	Door Hardware	10

DIVISION 9- FINISHES

092900	Gypsum Board	5
099113	Exterior Painting	5
099123	Interior Painting	5

DIVISION 10- SPECIALTIES

101100	Visual Display Surfaces	3
101423	Panel Signage	4
102800	Toilet, Bath, and Laundry Accessories	4
104416	Fire Extinguishers	2

DIVISION 11- EQUIPMENT

(Not Applicable)

DIVISION 12- FURNISHINGS

(Not Applicable)

DIVISION 20- MECHANICAL

200100	General Provisions – Mechanical	13
200200	Scope of the Mechanical Work	2
200300	Required Shop Drawings, Etc.	2
201100	Sleeving, Cutting, Patching, Firestopping & Repairing	4
201200	Excavation, Trenching, Backfilling & Grading	5
201300	Pipe, Pipe Fittings, & Pipe Support	5
202100	Valves & Cocks	2
202200	Insulation – Mechanical	3
202300	Thermometers, Pressure Gauges & Other Monitoring Instruments	1
202400	Identifications, Tags, Charts, Etc.	1
202500	Hangers, Clamps, Attachments, Etc.	3
203100	Testing, Balancing, Lubrication and Adjustments	3

DIVISION 22- PLUMBING

220100	Plumbing Specialties	5
220200	Plumbing Fixtures, Fittings and Trim	4

DIVISION 23- HVAC

230200	HVAC Equipment	2
231100	Registers, Grilles, Diffusers & Louvers	6
231200	Sheet Metal & Flexible Duct	4

DIVISION 25- BUILDING AUTOMATION SYSTEM

250100	Electrical Motors, Motor Starters and Other Elec. Req. for Mechanical Equip.	4
250400	Controls	20

DIVISION 26- ELECTRICAL

260500	General Provisions	16
260501	Description of Electrical System	1
260502	Scope of the Electrical Work	1
260503	Shop Drawings, Literature, Manuals, Parts Lists, and Special Tools	4
260504	Cutting, Patching & Repairing	2
260508	Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others	2
260515	Sports Lighting System	7
260519	Conductors, Identifications, Splicing Devices & Connectors	8
260526	Grounding	4
260531	Cabinets, Outlet Boxes & Pull Boxes	2
260533	Raceways & Fittings	9
260544	Excavation, Trenching, Backfilling & Grading	2
260553	Identifications	1
262400	Electrical Distribution Equipment	5
262726	Wiring Devices & Plates	8
262800	Electric Seismic Restraints	5
265113	Lighting	7

DIVISION 31- EARTHWORK

311000	Site Clearing	4
312000	Earth Moving	9
313116	Termite Control	3

DIVISION 32- EXTERIOR IMPROVEMENTS

321313	Concrete Paving	9
321818	Synthetic Turf Field	9
321819	Synthetic Turf Athletic Field – Add Alternate #1	2
323113	Chain Link Fences and Gates	8
323223	Segmental Retaining Walls	6
329200	Turf and Grasses	10

DIVISION 33- UTILITIES

334100	Storm Utility Drainage Piping	10
--------	-------------------------------	----

END OF INDEX TO SPECIFICATIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Northern Kentucky University Intramural Field and Support Building.

1. Project Location: 1 Nunn Drive, Highland Heights, KY 41099

B. Owner: Northern Kentucky University 1 Nunn Drive Highland Heights, KY 41099

1. Owner's Representative: Rob Knarr.

C. Architect: Omni Architects 212 N. Upper Street Lexington, KY 40507 (859) 252-6664

1. Architect's Representative: Jay Copley.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Associate Architect: Cannon Design
1100 Clark Avenue
St. Louis, MO 63102
(314) 241-6250
2. Structural Engineer: BFMJ
620 E. Euclid Avenue
Suite 300
Lexington, KY 40502
(859) 278-5050
3. Landscape Architect/Civil Engineer: Vivian Llambi & Associates
2312 Park Avenue
Cincinnati, OH 45206
(513) 559-0164

4. MEP Engineer: CMTA Consulting Engineers
10411 Meeting Street
Prospect, KY 40059
(502) 326-3085

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 1. The Work includes the construction of a new intramural field (composed of synthetic turf) and a support building consisting of an office, storage rooms and two restrooms.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of areas outside of the project limits for construction operations and parking as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
 2. Driveways, Walkways and Entrances: Keep driveways parking lots, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways, parking lots, and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Condition of Existing Storage Building: Maintain portions of existing storage building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.
 1. Weekend Hours: As negotiated with Owner.
 2. Hours for Utility Shutdowns: As negotiated with Owner, shutdowns shall only occur on third shift and weekends and any additional cost of utility company shutdowns are the Contractor's responsibility.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.8 SITE UTILITIES

- A. Cost: The costs associated with temporary electric and water shall be at the expense of the contractor and included in the base bid. Provide meters so that costs may be tracked and paid for by General Contractor.

1.9 PERMITS

- A. Cost: The costs and submittals required for permits by local authorities shall be the cost of the contractor and included in the base bid.

1.10 CONSTRUCTION SCHEDULE

- A. The date of commencement for the work shall be the date on the contract. The duration of the construction period through Substantial Completion is to be 180 days to achieve Substantial Completion after the date of commencement. Following Substantial Completion, 30 calendar days will be allowed to reach Final Completion. Liquidated Damages shall be imposed in the case that Final Completion is not reached in this time period.
- B. Phasing and Coordination: Contractor must coordinate the Work with the activities of the Owner so as not to interrupt the Owner's necessary activities. Utility and construction work must be coordinated as to allow continuous access to the adjacent buildings during normal working hours.

1.11 COMPLETION

- A. Should the Contractor fail to achieve Substantial Completion of the Work under the Contract within the duration stipulated (or such amended date as may result from extensions in the Contract Time granted by the Owner), the Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner, as liquidated damages, the sum of One Thousand Dollars (\$1,000.00) for each calendar day of delay after the established date for Substantial Completion in the Contract Documents until the Work is substantially completed.
- B. Should the Contractor fail to achieve Final Completion of the Work under the Contract on or before the duration stipulated (or such amended date as may result from extension in the Contract Time granted by the Owner), the Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner, as liquidated damages, the sum of One Thousand Dollars (\$1,000.00) for each calendar day of delay after the established date for Final Completion in the Contract Documents until the Work attains Final Completion.

1.12 CLAIMS BY THE CONTRACTOR / CONCEALED CONDITIONS / DISPUTES

- A. Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The contractor shall provide a "Critical Path" schedule before commencing the work as a baseline for establishing potential delays in the work. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.
- B. The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the numbers of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Temperature controls (Schneider Electric).
 - 2. Other allowances as issued by addendum.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
 - 2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
 - 3. Section 250400 "Control – Direct Digital" for scope of work.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each item described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect/Engineer from the designated supplier.

1.4 ACTION SUBMITTALS

- A. Submit proposals for revisions to purchase allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Quantity Allowance: Include Temperature Controls as specified in Section 250400.
 - 1. Allowance to be carried in base bid shall be \$12,800.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included. Specification Sections referenced in the schedule contain requirements for materials described under each unit price. Unit pricing may be applied for additive or deductive change orders.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES (Refer to Bid Forms)

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. One: Artificial Turf – Envirofill sand infill, with shock pad
 - 1. Base Bid: Provide (furnish and install) artificial turf as specified in Section 321818 with sand/rubber infill
 - 2. Alternate: Provide (furnish and install) artificial turf as specified in Section 321819 with Envirofill sand infill, with shock pad.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for administrative requirements for using unit prices.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

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 CSI Form 13.1A.
 - 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 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. 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 architects 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.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract 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 Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. 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 seven days 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 seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

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 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:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, 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 contractors involved.

- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: 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.
 - 1. 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:
 - a. 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.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, 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 contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request. After receipt of Proposal Request, 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 costs of labor and supervision directly attributable to the change.
 - d. 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 changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 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 costs of labor and supervision directly attributable to the change.

5. 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.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 4. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.

- e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent:
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts where appropriate.
 - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 - 6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
 - 8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
 - 9. Allowances: Provide a separate line item in the schedule for each allowance.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the date of the monthly progress meeting. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
- F. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- G. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- H. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.

13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
- D. LEED: The requirements for LEED Certification do not apply to this project.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. 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. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. 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. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.
- 1.6 REQUESTS FOR INFORMATION (RFIs)
- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. RFI subject.
 7. Specification Section number and title and related paragraphs, as appropriate.
 8. Drawing number and detail references, as appropriate.
 9. Field dimensions and conditions, as appropriate.
 10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

11. Contractor's signature.
 12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Use CSI Log Form 13.2B. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- 1.7 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site 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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communications.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 4. Minutes: Architect will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation 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 RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.

- h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at monthly intervals.
1. Coordinate dates of meetings with preparation of payment requests.

2. 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. 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.
 - 1) Review schedule for next period.
 - 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) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 - 19) Date of Substantial Completion
4. Minutes: Architect will record and distribute the meeting minutes to each party present and to parties requiring information.
 - 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages, area separations, interim milestones, and partial Owner occupancy.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures.
 - 10. Review and finalize list of construction activities to be included in schedule.

11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of 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: Treat each story or separate area as a separate numbered activity for each main element of the Work. 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 the following 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 Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 5 days for startup and testing.
 5. 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.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final 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. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.

- f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
 - k. Startup and placement into final use and operation.
 - 8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
 - 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. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
 - F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- 2.2 STARTUP CONSTRUCTION SCHEDULE
- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.
 - B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)
- A. General: Prepare network diagrams using AON (activity-on-node) format.
 - B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
 - C. CPM Schedule: Prepare Contractor's construction schedule using a computerized time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.

2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.4 REPORTS

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

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit 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.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each 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 final 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 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. 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.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06 1000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06 1000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.

- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- 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: Retain complete paper copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Certificates and Certifications Submittals: Provide a 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.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- 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 published 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 catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.

- c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- 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: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. 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.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. 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. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations

expected. Samples include, but are not limited to, the following: 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. Number of Samples: Submit three sets of Samples. Architect will two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. 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.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit 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.
- W. Field Test Reports: Submit written reports 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 in the Contract Documents.
- X. Design Data: Prepare and submit 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.

2.2 DELEGATED-DESIGN SERVICES

- 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.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, 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.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. 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. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:



SHOP DRAWING REVIEW

This review was performed only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Modifications or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review of a specific item does not include review of the assembly of which the item is a component. Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction; coordination of the work of all trades; and for performing all work in a safe and satisfactory manner.

- REVIEWED
- NOTE MARKINGS
- SUBMIT SPECIFIC ITEM
- REVISE AND RESUBMIT
- REJECTED
- NO ACTION TAKEN

By _____ Date _____

- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for 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. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: 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.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: 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 conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data : For Contractor's quality-control personnel.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- C. Testing Agency Qualifications: 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.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

- B. **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, as well as sufficient production capacity to produce required units.
- C. **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.
- D. **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.
- 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 in material, design, and extent to those indicated for this Project.
- F. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. **NRTL:** A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. **NVLAP:** A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. **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.
- I. **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. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.

1.7 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 types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
- C. 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. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- D. 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. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -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.
- F. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 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 Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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 014110 – STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.
- B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
 - 3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.
- C. The owner will engage one or more qualified special inspectors and Contractor will engage testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.
- D. Related Sections include but are not limited to the following:
 - 1. 023000 EARTHWORK
 - 2. 033000 CAST-IN-PLACE CONCRETE.
 - 3. 061000 ROUGH CARPENTRY.
 - 4. 042100 REINFORCED MASONRY CONCRETE

1.3 DEFINITIONS

- A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

- B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.
- C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.
- D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.
- E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.
- F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
- G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.
- H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.
 - a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
 - 2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

- A. General: 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 the registered design professional in responsible charge for a decision before proceeding.
- B. 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 the registered design profession in responsible charge for a decision before proceeding.
- C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.
- D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

- A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.
 - 1. Special inspection reports and test results shall include, but not be limited to, the following:
 - a. Date of inspection.
 - b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
 - c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.
 - 1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.
 - d. Name and signature of special inspector and / or testing agency representative performing the work.

- B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.
- C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.
- D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

- A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.
- B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.
- C. Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
 - 1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
 - 2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
 - 3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
 - 4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- D. Each contractor responsible for the construction of a main wind force-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
 - 1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.

2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
 3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
 4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- E. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.
1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
 2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
 3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.
- F. The contractor shall be responsible for costs of:
1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
 2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
 3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

- A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections.
- B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULES AND FORMS

4.1 STATEMENT OF SPECIAL INSPECTIONS.

4.2 SCHEDULE OF SPECIAL INSPECTIONS.

- A. See individual material specification sections for schedule of special inspections required.

4.3 FINAL REPORT OF SPECIAL INSPECTIONS.

END OF SECTION 014110

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 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. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).

48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; www.ec-central.org.
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Approval Services; (See CSA).
96. ICBO - International Conference of Building Officials; (See ICC).
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.

99. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
103. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
104. IESNA - Illuminating Engineering Society of North America; (See IES).
105. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
106. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
107. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
108. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
109. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
110. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
111. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
112. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
113. ISO - International Organization for Standardization; www.iso.org.
114. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
115. ITU - International Telecommunication Union; www.itu.int/home.
116. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
117. LMA - Laminating Materials Association; (See CPA).
118. LPI - Lightning Protection Institute; www.lightning.org.
119. MBMA - Metal Building Manufacturers Association; www.mbma.com.
120. MCA - Metal Construction Association; www.metalconstruction.org.
121. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
122. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
123. MHIA - Material Handling Industry of America; www.mhia.org.
124. MIA - Marble Institute of America; www.marble-institute.com.
125. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
126. MPI - Master Painters Institute; www.paintinfo.com.
127. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
128. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
129. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
130. NADCA - National Air Duct Cleaners Association; www.nadca.com.
131. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
132. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
133. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
134. NCMA - National Concrete Masonry Association; www.ncma.org.
135. NEBB - National Environmental Balancing Bureau; www.nebb.org.
136. NECA - National Electrical Contractors Association; www.necanet.org.
137. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
138. NEMA - National Electrical Manufacturers Association; www.nema.org.
139. NETA - InterNational Electrical Testing Association; www.netaworld.org.
140. NFHS - National Federation of State High School Associations; www.nfhs.org.
141. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
142. NFPA - NFPA International; (See NFPA).
143. NFRC - National Fenestration Rating Council; www.nfrc.org.
144. NHLA - National Hardwood Lumber Association; www.nhla.com.
145. NLGA - National Lumber Grades Authority; www.nlga.org.
146. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
147. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.

148. NRCA - National Roofing Contractors Association; www.nrca.net.
149. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
150. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
151. NSPE - National Society of Professional Engineers; www.nspe.org.
152. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
153. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
154. NWFA - National Wood Flooring Association; www.nwfa.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.
157. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; www.redwoodinspection.com.
161. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
167. SIA - Security Industry Association; www.siaonline.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
178. STI - Steel Tank Institute; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
184. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
185. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
186. TMS - The Masonry Society; www.masonrysociety.org.
187. TPI - Truss Plate Institute; www.tpinst.org.
188. TPI - Turfgrass Producers International; www.turfgrassod.org.
189. TRI - Tile Roofing Institute; www.tilerroofing.org.
190. UBC - Uniform Building Code; (See ICC).
191. UL - Underwriters Laboratories Inc.; www.ul.com.
192. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.
195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WASTEC - Waste Equipment Technology Association; www.wastec.org.
197. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.

200. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
201. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
202. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
203. WPA - Western Wood Products Association; www.wwpa.org.

C. 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. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. 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. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 312319 "Dewatering" for disposal of ground water at Project site.
 - 3. Section 321216 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
 - 4. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

1.7 NORTHERN KENTUCKY UNIVERSITY SAFETY REQUIREMENTS

- A. The University strives to continuously maintain both a safe and secure work environment for its students, employees, and the employees of all Contractors assigned to our campus. Therefore, it is essential the following criteria be met by all Contractors (and all their subcontractors) working at NKU.

- B. **BACKGROUND CHECKS:** The Contractor shall furnish the University with written documentation that verifies each of their employees working on the property of the University has cleared a background check, has no felony convictions, is not a sex offender, and has the legal right to work in the United States.
- C. **DRUG-FREE WORKPLACE:** Northern Kentucky University is a drug-free and alcohol-free workplace, and all employees of Contractors and subcontractors are subject to this policy while working on University property. If there is verifiable suspicion or probable cause that an employee of the contractor or subcontractor is under the influence of drugs or alcohol, the University reserves the right to require the Contractor to have the employee tested immediately at no expense to the University. If the test results are positive the employee will be prohibited from working on University property for a period of one (1) year from the positive test, or the duration of the project, whichever is longer. The banned employee of the Contractor must pass a drug and alcohol test before working again on university property.
- D. **CONTRACTOR PRESENCE ON CAMPUS:** All persons working for (or on behalf of) the Contractor whose duties bring them on campus shall obey the rules and regulations that are established by the University and shall comply with the reasonable directions of the University representatives. Contractor's employees shall never enter or use existing areas of campus where they are not required to be performing work. Contractors and subcontractors are always responsible for providing and maintaining portable restroom facilities for all their workers working on the project. Contractor shall be responsible for the acts of his employees and agents while on campus. Accordingly, Contractor agrees to take all necessary measures to prevent injury and loss to persons or property located on campus.

Contractor shall be responsible for all damages to persons or property caused by Contractor or any of his agents or employees. Contractor shall promptly repair any damage that he, or his employees or agent may cause to the campus or to the University equipment.

Contractor agrees that in event of an accident or incident of any kind on university property, Contractor will immediately notify the University's Department of Public Safety (859-572-5500), who will prepare and furnish a full written report of the accident or incident.

All Contractor employees and subcontractors shall present a neat and clean appearance while on University property, and be able to present proper individual and company identification upon request.

- E. **PROJECT WORK SITE SAFETY & SECURITY:** The University does not, and will not, assume any responsibility for any tools, materials, equipment, or property belonging to the Contractor, his employees or agents, which may be lost or stolen from University property. All contractors and subcontractors are solely responsible for properly securing and protecting their tools and equipment.
- F. **GENERAL PROJECT COORDINATION:** All work and information requests by the Contractor shall be coordinated through the assigned NKU Project Manager. Any direction provided by the campus Operations & Maintenance Staff and/or the project user group shall NOT be considered official direction from the University unless authorized in writing from the assigned NKU Project Manager. Contractor will NOT be compensated for work performed without written authorization from the assigned NKU Project Manager or NKU-hired Architect of Record.

As a general rule, utilities required by the Contractor to perform their work can be obtained from the University. However, the University will require the Contractor to furnish a meter to record the usage of each provided utility for the duration of the project. A deduct change order will be issued at the end of the Project to reimburse the University for the Contractor utility usage. The Contractor is responsible for determining and coordinating the procurement of any utility where the University cannot reasonably provide.

Unless noted otherwise for a specific project, at least seven (7) calendar day notice is required for any campus utility shutdowns and/or any road/parking lot closures necessary for the Contractor to perform their work. All utility shutdowns and closures shall be coordinated with the assigned NKU Project Manager, and the University reserves the right to schedule these shutdowns and closures at night and/or on weekends to minimize disruptions to the campus community.

The NKU project manager will research and provide whatever information is available and known for the existing utilities in the area of concern. However, NKU will require the contractor hire an outside utility locating service for marking the location of all existing utilities. Outside utility locating services will be required for locating all public utilities (when applicable), and most of the underground utilities on campus are private "house" lines owned & maintained of NKU. All requests for assistance from NKU's Operations & Maintenance staff in locating existing utilities shall also be submitted to the assigned NKU project manager at least three (3) calendar days in advance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. At Contractor's option, provide the following:

1. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.
2. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

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 by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect and meter to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use. Contractor shall include budget in base bid. A change order will be prepared at the end of project on actual usage.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- F. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Connect and meter to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service underground unless otherwise indicated.
 - 2. Connect temporary service to Owner's existing power source and meter. Contractor will be charged for usage and contract amount reduced by change order at end of project.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.

- d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- L. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail in common-use facilities.
1. Provide DSL in primary field office.
- 3.3 SUPPORT FACILITIES INSTALLATION
- A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Architect schedules Substantial Completion inspection. 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 adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as required. Unauthorized signs are not permitted.
1. Signs: Provide Project identification signs at Kenton Drive, and safety warning signs at gates.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Protect plant material outside of project limits.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 1. Extent of Fence: As required to enclose entire Project site determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- I. Barricades and Warning Signs: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Provide safety signage at gate. Provide directional signage for deliveries.
- J. Temporary Egress: Maintain temporary egress from existing occupied parking lot as indicated and as required by authorities having jurisdiction. Maintain existing parking lot and clean and clear of construction mud and debris.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

3.5 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.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. 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 property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction. The Contractor will not be required to resurface the basketball court staging area. However, the Contractor shall endeavor to minimize damage to the existing basketball courts.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 014200 "References" for applicable industry standards for products specified.
 - 4. Section 012100 "Allowances" for products selected under an allowance.

1.3 DEFINITIONS

- A. Products: Items obtained 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. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
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 determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.

1.7 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.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require 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

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of site elements.
 - 5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 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 underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to all parties 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. 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.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

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 limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. 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 rim 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, including those required for mechanical and electrical work. 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. Identification: Owner will identify any existing benchmarks, control points, and property corners.
- B. 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.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. 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.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

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.
 - 4. Maintain minimum headroom clearance of 8 feet in occupied spaces and 8 feet in unoccupied spaces.
- 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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect and in compliance with Universal Access codes.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. 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.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- 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. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. 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.
- I. 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.
- J. 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.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 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.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of site improvements, and for disposition of hazardous waste.
 - 2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction 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.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

- A. General: Remove waste materials from Project site and legally dispose of them in a landfill or incinerator 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 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

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

1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.

1.6 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: 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, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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.
- D. 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 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site, 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. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Clean transparent materials, including mirrors. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Clean mechanical systems.
 - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - o. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 1. Remove and replace chipped, scratched, and broken mirrors, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

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

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
 - 3. Contractor to provide two external hard-drives with all closeout submittals saved in PDF format.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
 - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.

4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

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

- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

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

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.

2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Final Submittal:
 - 1) Submit one paper-copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: 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 provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
- a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications 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. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as paper copy and scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as paper copy and scanned PDF electronic file(s) of marked-up paper copy of Product Data.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. 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.
- B. Format: Submit miscellaneous record submittals as paper copy and scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings are not required.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.

- c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Owner will furnish Contractor with names and positions of participants.

- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected site elements.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Basketball court goals.
 - b. Baseball accessories.
 - c. Benches.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review site survey of existing construction and remove site elements not incorporated into final work. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements necessary to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove plumbing, and electrical systems indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective site demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
 - B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of site.
 2. Provide temporary safety signage.
 3. Provide temporary safety precautions for site utilities located outside of Project limits.
- 3.4 SELECTIVE DEMOLITION, GENERAL
- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically.
 2. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
 - B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.
- 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Concrete and Asphalt: Demolish in small sections. Using power-driven saw, cut pavement at junctures with construction to remain. Dislodge pavement from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of pavement. Neatly trim to dimensions indicated.
- 3.6 DISPOSAL OF DEMOLISHED MATERIALS
- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
 - B. Burning: Do not burn demolished materials.
 - C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- 3.7 CLEANING
- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK & RELATED REQUIREMENTS

- A. Provide labor, transportation, materials, tools, equipment and appliances necessary for proper and complete installation of all concrete work.
- B. Concrete paving and walks are specified in Division 32.
- C. Architectural Concrete is specified in another Division 3 Section.
- D. Special Inspections are specified in Section 014110.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, shrinkage-resistant grout, and any others that may be requested by Engineer or Architect.
- B. Shop Drawings, General: All shop drawings submitted shall be a complete set of original drawings created by the Supplier. No partial or incomplete submittals nor duplication of Engineer or Architect original documents will be permitted.

1. All shop drawing submittals shall include 3 sets of prints for structural consultant to review and mark up. (Note number of prints may be increased by Architect/Engineer at the Preconstruction Conference.)
2. Shop drawings must not only bear the Contractor's stamp of approval but shall also show evidence that each item has been thoroughly checked. Failure to comply with this requirement shall result in the Engineer's return of the submission (without review or action) for the Contractor's proper submission and review. No exceptions shall be taken.
3. Copies of shop drawings used in the field shall bear the Engineer's and Architect's review stamp with items checked to indicate a satisfactory final review.
4. Minimum Requirements for Electronically Submitted Structural Shop Drawings:
 - a. No partial submittals will be accepted. Submittal will be returned without review.
 - b. No incomplete submittals will be accepted.
 - c. Submittal must include:
 - 1) One hard copy of both erection drawings and piece drawings.
 - 2) Hard copy must have been reviewed and noted as such by general contractor/construction manager.
 - 3) All piece marks must be on erection drawings.
 - 4) All elements of the erection drawings must be named and in piece drawings.
 - 5) A list of drawings submitted must be enclosed.
 - 6) Submitted drawing must be in PDF format.

- C. Shop Drawings; Reinforcement: Prior to fabrication, submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- D. Shop Drawings; Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces as indicated. Show general construction of forms including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually.
 - 1. Architect/Engineer's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the Contractor's responsibility.
- E. Samples: Submit samples of materials as specified and as otherwise requested by Engineer or Architect, including names, sources and descriptions.
- F. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.
- G. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
- H. All submittals required in Section 1.4, "Quality Assurance."

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified.
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 304 "Recommended Practices for Measuring, Mixing, Transporting and Placing Concrete".
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - 5. ANSI/AWS D1.4 "Structural Welding Code -- Reinforcing Steel".
 - 6. ACI 117 – 90 "Standard Tolerances for Concrete Construction and Materials".
- B. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Owner for final acceptance.
- C. All sampling and/or testing in the field shall be made by an ACI Concrete Field Testing Technician Grade I in accordance with ACI CP1 or equivalent.
- D. Testing agencies shall meet the requirements of "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction," ASTM E 329, latest edition.
- E. Quality control concrete testing service: For non – special inspection applications:
 - 1. The General Contractor is to engage a testing laboratory acceptable to Engineer and Architect at Contractor's expense to perform the following services:

- a. Qualification of proposed materials and the establishment of mix designs in accordance with "Building Code Requirements for Reinforced Concrete," ACI 318, latest edition and as noted under Proportioning and Design of Mixes listed elsewhere in this section.
- b. See Section 3.13 Quality Control Testing During Construction For Required Tests.
- c. Testing services needed or required by the Contract.
- d. Correct deficiencies in structural work which inspections have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

F. Special Inspections:

1. The Owner is to hire the Special Inspector(s) to meet the requirements for concrete construction listed in Chapter 17 of the 2007 KBC, Section 1704.4. Attached at the end of this specification for the convenience of the contractor is a reprint of KBC table 1704.4, "Concrete Construction Special Inspections."
2. The concrete batch plant is to submit all necessary paperwork or hire a Special Inspector to meet the requirements for inspection of fabricators listed in Chapter 17 of the 2007 KBC, Section 1704.2.
3. The General Contractor is responsible for providing access to the site for the Owner's Special Inspector and for coordinating the Special Inspector's site visits with ongoing work.

G. Materials and installed work may require testing and retesting, as directed by Engineer, at anytime during progress of work. Allow free access to material stockpiles and facilities. Tests including retesting of rejected materials and installed work shall be done at Contractor's expense.

H. Preinstallation Conference:

1. At least 14 days prior to the start of the concrete construction schedule, the Contractor shall conduct a preinstallation conference at the project site to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction.
2. The Contractor shall require representatives of every party who is concerned with the concrete work to attend the conference, including, but not limited to, the following:
 - a. Contractor's superintendent
 - b. Material Testing Agency
 - c. Concrete subcontractor
 - d. Engineer
 - e. Special Inspector
 - f. Architect
3. Minutes of meeting shall be recorded, typed, printed and distributed by (Construction Manager/General Contractor) within three days of the meeting.

1.5 PROJECT CONDITIONS

- A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- B. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Forms for Cylindrical Columns and Supports: Metal, fiberglass reinforced plastic.
- D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.
 - 1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Bars indicated to be welded shall conform to ASTM A706.
- B. Welded Wire Fabric: ASTM A 185 welded steel wire fabric. Provide flat sheets only.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).
 - 3. For elevated slabs on metal deck, use standard chairs to position reinforcement at mid-height above deck ribs, unless otherwise shown.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I, Type II, Type II Table 2, or Type III, unless otherwise acceptable to Engineer.
 - 1. Use one brand of cement throughout project, unless otherwise acceptable to Architect/Engineer.
- B. Fly-Ash: ASTM C 618, Type F.
 - 1. Limit use of fly-ash in normal weight concrete limit use of fly ash to not exceed 15% of cement content by weight nor 80 pounds of fly ash per cubic yard.

- C. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
1. Fine Aggregates - shall consist of natural sand having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, organic matter, loam, or other deleterious matter.
 2. Coarse Aggregate - shall be crushed stone or gravel having clean, hard, uncoated particles and free from injurious amounts of soft, friable, thin, elongated or laminated pieces. Aggregates shall not absorb more than 3% moisture by weight. Coarse aggregates shall be standard size #67.
- D. Aggregate for Concrete Fill (Grout): Pea gravel or 3/8" crushed limestone.
- E. Water: Drinkable.
- F. Air-Entraining Admixture: ASTM C 260 products. Subject to compliance with requirements, provide one of the following:
- "Air-Mix"; Euclid Chemical Company
"Sika AER"; Sika Corporation
"MB-VR" or "Micro-Air"; Master Builders
"Darex II"; W. R. Grace
"RVR-15" or "RSA-10"; Russtech
Or equal
- G. Water-Reducing Admixture: ASTM C 494, Type A, and contain not more than 0.1% chloride ions. Type A, Water-Reducing admixture shall be a hydroxolated polymer type admixture. Admixtures that are predominantly composed of hydroxolated carboxylic acid or lignin sulfonates are not permitted.
1. Products: Subject to compliance with requirements, provide one of the following:
"Eucon WR-75" or "WR-89"; Euclid Chemical Company
"Plastocrete 161"; Sika Corporation
"Polyheed 997" or "Pozzolith 322N"; Master Builders
"WRDA-Hycol" or "Daracem 55"; W. R. Grace
"Finishease-NC" or "LC-400"; Russtech
Or equal
- H. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and contain not more than 0.1% chloride ions. Superplasticizer shall have the performance capabilities to be added to the concrete at the Ready mix plant without rapid slump loss problems. Job site added superplasticizers shall not be permitted.
1. Products: Subject to compliance with requirements, provide one of the following:
Eucon 37"; Euclid Chemical Corp.
"Sikament 300"; Sika Corporation
"Rheobuild 1000" or Polyheed 997"; Master Builder
"WRDA-19" or "Daracem 100"; W.R. Grace
"Superflo 440, 440R or 443", Russtech
Or equal
- I. Water-Reducing, Accelerator Admixture: ASTM C 494, Type C or E. Only non- chloride accelerators shall be permitted.
1. Products: Subject to compliance with requirements, provide one of the following:
"Accelguard 80"; Euclid Chemical Co.
"Pozzutec 20"; Master Builders.
"LCNC-166"; Russtech

"Polarsek"; W.R. Grace
Or equal

- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.1% chloride ions.

1. Products: Subject to compliance with requirements, provide one of the following:

"Eucon Retarder 75"; Euclid Chemical Company
"Plastiment"; Sika Corporation
"Pozzolith 122-R", Master Builders
"Daratard-17"; W. R. Grace Co.
"LC-400R" or "LC-400P"; Russtech
"Superflo 440R"; Russtech
Or equal

- K. Prohibited Admixtures: Calcium chloride thycyanates or admixtures containing more than 0.1% chloride ions are not permitted.

2.4 RELATED MATERIALS

- A. Granular Base: Compacted layer of #57 stone, unless otherwise approved or directed by Architect.

Vapor retarder: Provide vapor retarder cover above prepared base material for slabs on grade which meets ASTM E 1745 Class A. Use only materials which are resistant to decay when tested in accordance with ASTM E 154 and has maximum Water Vapor Permeance value of .04 perms or less when tested with ASTM E 96 as follows:

Perminator 10 mil by W.R. Meadows.

Stego-Wrap 10 mil by Stego Industries

Or equal

- B. Non-Shrink Grout: CE-CRD-C 621, Type D, non-metallic, factory pre-mixed grout.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. "Set Grout"; Master Builders.
"Sonogrout"; Sonneborn.
"Euco-NS"; Euclid Chemical Co.
"Duragrout"; L & M Const. Chemical Co.
Or equal

- b. "5 Star Grout 100"; Five Star Products
"Master Flow 928"; Master Builders
Or equal

- C. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

- D. Concrete Curing Compound shall comply with ASTM C-309, Type 1, Class B. Manufacturers offering products complying with requirements include:

Master Builders; MB429
Sonneborn-Contech; Kure-N-Seal 800

W. R. Meadows, Inc.; CS-309
Or equal

E. Bonding Compound: Polyvinyl acetate, rewettable type.

1. Products: Subject to compliance with requirements, provide one of the following:

"Weldcrete"; Larson Products.
"Everbond"; L & M Construction Chemicals.
"Euroweld"; Euclid Chemical Co.
"Daraweld C"; W.R. Grace
"Sonocrete"; Sonneborn-Contech.
Or equal

F. Epoxy Adhesive: 100% solids, two component material suitable for use on dry or damp surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

"Thiopoxy"; W.R. Grace.
"Sikadur Hi-Mod"; Sika Chemical Corp.
"Euco Epoxy"; Euclid Chemical Co.
Or equal

G. Expansion Joint Material: Shall be a pre-formed expansion joint filler for concrete paving and structural construction (non-extruding and resilient bituminous types) per ASTM D 1751.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. General - concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water, and as specified, admixtures. Proportions of ingredients shall produce concrete that will work readily into corners and angles of forms, bond to reinforcement, without segregation or excessive bleed water forming on surface. Proportioning of materials shall be in accordance with ACI 211.1-91, "Recommended Practice for Selecting Proportions for Normal, Heavyweight & Mass Concrete."

B. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer.

C. Submit written reports to Engineer of each proposed mix for each class of concrete at least 45 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved by Engineer.

D. Required Average Strength Above Specified Strength: Determinations of required average strength (fcr) shall be in accordance with ACI 318, "Building Code Requirements for Reinforced Concrete," and evaluations of compressive strength results of field concrete shall be in accordance with ACI 214-88, "Recommended Practice for Evaluation of Strength Test Results of Concrete."

1. Trial Mixes when the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work based on ACI 211.1, using at least three different water-cement ratios which will produce a range of strengths encompassing those required.

a. Average strength (fcr) required shall be 1200 psi (8.3 MPa) above specified strength.

2. Past Field Experience - proportions shall be established on the actual field experience of the ready-mix producer with the materials proposed to be employed. Standard deviations shall be determined by 30 consecutive tests (or two groups of tests totaling 30 or more).
 - a. Average strength (f_{cr}) shall exceed specified strength (f 'c) by at least:
 - 400 psi (2.8 MPa) - standard deviation is less than 300
 - 550 psi (3.8 MPa) - standard deviation is 300 to 400
 - 700 psi (4.8 MPa) - standard deviation is 400 to 500
 - 900 psi (6.2 MPa) - standard deviation is 500 to 600
 - 1200 psi (8.3 MPa) - standard deviation is above 600 or unknown
- E. Design mixes to provide normal weight concrete with the design strengths as indicated on drawings. The average strength shall exceed specified compressive strength as required in accordance with ACI 318.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.
- G. Admixtures:
 1. Use Type A water-reducing admixture in concrete.
 2. High range water-reducing admixture (super plasticizer) or mid-range water reducing admixture may be used in concrete with Engineer's approval.
 3. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50° F (10° C).
 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:
 - 1) 5% ± 1%
 5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- H. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 1. Slabs, ramps and sloping surfaces: Not more than 3" with ordinary WRA, or 6" with MRWR.
 2. Reinforced foundation systems: Not less than 2-1/2" and not more than 4" except Foundation Walls slump to be 5" to 6".
 3. Other concrete: Not less than 1" nor more than 4".
 4. Concrete containing MRWR admixture (mid-range): Not more than 6".
 5. Concrete containing HRWR admixture (super plasticizer): Not more than 8".

2.6 CONCRETE MIXES

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
 2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
 3. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes. Mixing and delivery time will not have to be reduced if Type D retarder is incorporated in the mix.
 4. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

PART 3 - EXECUTION

3.1 FORMS

General: Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel. Side forms of footings may not be omitted and concrete placed directly against excavation except when a written request by Contractor and accepted by the Engineer and Architect in writing. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed at contractor's cost. NOTE THAT THE EXTERIOR GRADE BEAM FACES WILL ALWAYS REQUIRE FORMING.

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.
 2. Unless otherwise shown, provide form ties which will not leave holes larger than 1" diameter in concrete surface.
- H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.
- 3.2 VAPOR BARRIER INSTALLATION
- A. Place vapor barrier above compacted granular base.
 - B. Lap joints 6" and seal with appropriate tape.
- 3.3 PLACING REINFORCING
- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
 1. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.
 - B. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.
 - C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - D. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - E. Lap adjoining pieces of welded wire fabric at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. All WWR shall be properly supported with standard chairs or concrete brick (for slab on grade). 'Hooking and lifting' or 'floating-in' will not be permitted for any type of construction (slab on grade or supported slabs).
- 3.4 JOINTS
- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Engineer and Architect. Submit locations to Engineer and Architect for review.
 - B. Contraction (Control) Joints (CJ) in Slabs-On-Ground: Construct control joints in slabs-on-ground to form panels of patterns as shown or noted. Saw cut joints 1/4 of slab depth or use inserts 1/4" wide x 1/4 of slab depth unless otherwise indicated.
 1. Control joints may be formed by saw cuts as soon after slab finishing without dislodging aggregate but no later than twelve (12) hours of placing concrete.
 2. Joint sealant material is specified in Division-7 sections of these specifications.

- C. Expansion Joints (EJ) in Slabs-On-Ground: Construct expansion joints in slabs on ground between exterior and interior Concrete Slabs and between exterior slabs and vertical surfaces and where otherwise indicated on the drawings.

- 1. Sealants and caulk materials are specified in Division 7 sections of these specifications.

3.5 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.6 PREPARATION OF FORM SURFACES

- A. Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.7 CONCRETE PLACEMENT

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- F. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

- G. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- H. Maintain reinforcing in proper position during concrete placement operations.
- I. Cold Weather Placing:
 - 1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
 - 2. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
 - 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 4. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- J. Hot Weather Placing:
 - 1. When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
 - 2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90° F (32° 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.
 - 3. 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 embedment in concrete.
 - 4. Fog spray forms, reinforcing steel and subgrade thoroughly just before concrete is placed.
 - 5. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.8 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: Provide a smooth form finish to formed concrete surfaces exposed-to-view, or that are to be abrasive blasted . This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projections completely removed and smoothed.
- C. Refer to section 033300 for final finish.

3.9 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

1. After placing slabs, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Flatness and levelness requirements are listed later in this section.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, paint or other thin film finish coating system.
 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling and when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance equal to the limits specified in the 'float finish' paragraph 'B' above. Grind smooth surface defects which would telegraph through applied floor covering system. Flatness and levelness requirements are listed later in this section.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming. Flatness and levelness requirements are listed later in this section.
- E. Flatness and Levelness Requirements (unless otherwise noted):
 1. Slab on Grade: Check and level surface plane to a tolerance for floor flatness (F_F) = 30 overall value and minimum local value of 25 and floor levelness (F_L) = 25 overall value and minimum local value of 20.
 2. All testing and sampling to conform to ASTM E11-55.

3.10 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
 1. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
 - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by

power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Coordinate curing/sealing compounds with coating materials to verify compatibility of materials.

- b. Use moisture retaining covering in lieu of membrane curing compound on surfaces which are to be covered with coating materials applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, (such as ceramic or quarry tile or glue down carpet), resinous epoxy finish, painting, and other coatings and finish materials, unless it can be documented that no reaction or bonding problem will be developed. See finish schedule(s) for proper coordination and extent of these materials.
 - c. All interior slabs that are to remain exposed and that are not to receive special coating materials shall be cleaned and covered with one additional coat of curing and sealing compound after all construction traffic is off of slab surface.
2. Provide moist curing by one of the following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
 3. Provide moisture-cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 4. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
 - a. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.11 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.12 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
- B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

- C. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- D. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer or Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
- E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
- G. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
- H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect/Engineer.
- J. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- K. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sand concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- L. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.
- M. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material.
- N. Repair methods not specified above may be used, subject to acceptance of Engineer and Architect.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Sampling Fresh Concrete, ASTM C 172, except modified for slump to comply with ASTM C 94. Sampling and testing for quality control during placement of concrete shall include the following:
 - 1. Slump: ASTM C 143; one test for each set of compressive strength test specimens.

2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens. (Regardless of air-entrained or not).
 3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above.
 4. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required, 1 reserved for later testing if required.
 5. Compressive Strength Tests: ASTM C 39; one set for each 100 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 reserved for later testing if required.
 - a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - b. When total quantity of a given class of concrete is less than 50 cu. yards., strength test may be waived by Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.
 - c. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - d. Strength level of concrete will be considered satisfactory if 90% of strength test results and averages of all sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.
 6. Weight: Measure the weight of each set of cylinders and record the calculated unit weight.
- B. As previously described, floor flatness and levelness is to be measured within 72 hours and before any shoring is removed per ASTM E-11. See previous section under Part III Execution for additional requirements.
- C. Test results will be reported in writing from the testing agency to the Engineer and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
- D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer or Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END SECTION

**CONCRETE CONSTRUCTION SPECIAL INSPECTION
KBC Table 1704.4**

INSPECTION TASK	FREQUENCY OF INSPECTION		REFERENCE FOR CRITERIA	
	Continuous	Periodic	Referenced Standard	KBC Reference
1. Inspection of reinforcing steel, including prestressing tendons, and placement		X	ACI 318: 3.5, 7.1-7.7	1903.5, 1907.1, 1907.7, 1914.1
2. Inspection of reinforcing steel welding a. Verification of weldability of reinforcing steel other than ASTM A706. b. Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special reinforced concrete shear walls and shear reinforcement. c. Shear reinforcement d. Other reinforcing steel	X	X	AWS D1.4 ACI 318: 3.5.2	1903.5.2
3. Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased	X			1912.5
4. Verifying use of required design mix.		X	ACI 318: Ch.4, 5.2-5.4	1904, 1905.2-1905.4, 1914.2, 1914.3
5. Sampling fresh concrete and performing slump, air content and determining the temperature of fresh concrete at the time of making specimens for strength tests	X		ASTM C172, C31, ACI 318: 5.6, 5.8	1905.6, 1914.10
6. Inspection of concrete and shotcrete placement for proper application techniques	X		ACI 318: 5.9, 5.10	1905.9, 1905.10, 1914.6, 1914.7, 1914.8
7. Inspection for maintenance of specified curing temperature and techniques.		X	ACI 318: 5.11-5.13	1905.11, 1905.13, 1914.9
8. Inspection of prestressed concrete: a. Application of prestressing forces. b. Grouting of bonded prestressing tendons in the seismic-force-resisting system	X X		ACI 318: 18.18 ACI 318: 18.16.4	
9. Erection of precast concrete members		X	ACI 318: Ch. 16	
a. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.		X	ACI 318: 6.2	1906.2

SECTION 033300 - ARCHITECTURAL CONCRETE

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 cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes for round exposed columns.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and flatwork finishes.
 - 3. Section 033000 "Cast-in-Place Concrete."

1.3 DEFINITIONS

- A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance. Comply with Section 033000 "Cast-in-Place Concrete."
- B. Design Reference Sample: Refer to NKU Student Union for standard finish texture and effect.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. Source Limitations for Cast-in-Place Architectural Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 6, "Architectural Concrete."
 - 2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures that are not a part of "Special Inspections."

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork and other form-facing material requirements.
- B. Forms for Cylindrical Columns: Metal, glass-fiber-reinforced plastic tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

2.2 STEEL REINFORCEMENT AND ACCESSORIES

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Comply with Section 033000 "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 FORMWORK

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.
- B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.
- C. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class B, ¼ inch (6 mm).
- D. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
 - 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 - 2. Do not use rust-stained steel form-facing material.
- F. Do not chamfer exterior corners and edges of cast-in-place architectural concrete.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- J. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form

liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 REINFORCEMENT AND INSERTS

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

3.3 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
 - 4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water 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.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.4 FINISHES, GENERAL

- A. Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
 - 1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

- C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.5 EXPOSED-AGGREGATE FINISHES

- A. Abrasive-Blast Finish: Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa). Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.
 - 1. Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.
 - 2. Abrasive Blasting: Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
 - 3. Hand-rubbing or parging of concrete column will not be considered a final solution.

3.6 FIELD QUALITY CONTROL

- A. General: Comply with field quality-control requirements in Section 033000 "Cast-in-Place Concrete."

3.7 REPAIRS, PROTECTION, AND CLEANING

- A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
 - 1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.
- B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
- C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.
- D. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
 - 1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 033300

SECTION 042100 – REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Documents affecting work of this Section include, but are not limited to, Conditions of the Contract and Sections in Division 1 of these Specifications.

1.2 RELATED DOCUMENTS

- A. ACI 530.1/ASCE 6/TMS 602 “Specification for Masonry Structures”.
- B. ACI 530-02/ASCE 5-02/TMS 402-2 “Building Load Requirements for Masonry Structures”.
- C. Related Sections of specifications include:
 - 1. Division 4 Section 042200 “Concrete Unit Masonry” Requirements of the specification must be used together with this Specification.
 - 2. Division 7 Section 071113 “Bituminous Dampproofing” for dampproofing applied to cavity face of exterior block.
 - 3. Division 7 Section 079200 “Joint Sealers”.

1.3 SCOPE OF WORK

- A. Extent of each type and location of reinforced concrete masonry work is indicated on the drawings.

1.4 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- B. Product Data: Submit manufacturer’s product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

- C. Shop Drawings, General: All shop drawings submitted shall be a complete set of original drawings created by the Supplier. No partial or incomplete submittals nor duplication of Engineer or Architect original documents will be permitted.
1. All shop drawing submittals shall include 2 sets of prints and 1 sepia for structural consultant to review and mark up. (Note number of prints may be increased by Architect/Engineer at the Preconstruction Conference.)
 2. Shop drawings must not only bear the Contractor's stamp of approval but shall also show evidence that each item has been thoroughly checked. Failure to comply with this requirement shall result in the Engineer's return of the submission (without review or action) for the Contractor's proper submission and review. No exceptions shall be taken.
 3. Copies of shop drawings used in the field shall bear the Engineer's and Architect's review stamp with items checked to indicate a satisfactory final review.
- D. Submit material certificates for the following:
1. Each different concrete masonry unit indicated, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Each material and grade indicated for reinforcing bars.
 5. Each type and size of joint reinforcement.
 6. Each type and size of anchors, ties, and metal accessories.
- E. Submit material test reports from qualified independent testing laboratory, employed and paid for by Contractor, indicating and interpreting test results relative to compliance of following proposed masonry materials with requirements indicated:
1. Prism Strength(s): Submit previous test results for similar type of previously used masonry units. (See subsequent requirements listed later in this section for on-going tests required).
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include description of type and proportions of ingredients per ASTM C 270, for mortar mixes required to comply with proportion specifications.
 2. Include description of type and proportions of ingredients per ASTM C 476, for grout mixes required to comply with proportion specifications.

- G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602. The minimum design strength of the wall is to be $f'_m = 1,500$ psi at 28 days.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- I. The Daily Masonry Reports required by section 3.17 shall be collected and submitted to the Engineer and Architect weekly.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
 - 1. ACI 530-02/ASCE 5-02 Building Code Requirements For Masonry Structures.
 - 2. ACI 530.1-02/ASCE 6-02 Specifications for Masonry Structures.
- B. The contractor is to engage an independent testing laboratory capable of performing the quality control material testing required by this specification. The Testing Laboratory must be acceptable to the Owner, Architect and the Engineer.
- C. Special Inspections:
 - 1. The Owner is to hire the Special Inspector to meet the requirements for masonry construction listed in Chapter 17 of the 2007 KBC, Section 1704.5. Attached at the end of this specification for the convenience of the contractor is a reprint of KBC table 1704.5.1, "Level 1 Special Inspections."
 - 2. The masonry unit manufacturer batch plant is to submit all necessary paperwork to verify and prove that the Concrete Masonry Blocks satisfy the required Compressive Strength of Section 2.2.A of this Specification (see also Sections 1.4.D.1, and 1.4.E.1), or The value of f'_m shall be determined by tests according to Section 3.9.A.2 of this Specification and **additional cost of this test will be the responsibility of contractor.**
 - 3. The General Contractor is responsible for providing access to the site for the Owner's Special Inspector and for coordinating the Special Inspector's site visits with ongoing work.
- D. Pre-masonry Installation Conference:
 - 1. At least 14 days prior to the scheduled start of CMU construction, the Contractor shall conduct a pre-masonry installation conference at the project site to review the construction procedures.

2. The Contractor shall require representatives of every party who is concerned with the concrete masonry work to attend the conference, including, but not limited to, the following:
 - a. Contractor's superintendent
 - b. Material Testing Agency
 - c. Mason
 - d. Owner
 - e. Architect
 - f. Structural Engineer
 - g. Special Inspector and or Inspector
 3. Minutes of the meeting shall be recorded, typed and printed and distributed by the Contractor within three (3) days of the meeting.
- E. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- F. Unit Masonry Manufacturers Qualifications: Firms that have 2 years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.
1. Manufacturer must be producer member of the National Concrete Masonry Association (NCMA) and/or participate in its Plant Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry. Defective units are not permitted for decorative units on exterior face of building.

2.2 CONCRETE MASONRY UNITS (CMU)

- A. General: All blocks used in reinforced CMU shall be 2 cell block made of light weight aggregate and shall be of load bearing type with a compressive strength of not less than 2150 psi net area at 28 days. Units shall meet the current specification of ASTM C-90; Type 1 (Prism strength of masonry units shall be a minimum of 1500 psi at 28 days).
- B. Refer to Section 042200 "Concrete Unit Masonry" for masonry materials and accessories not included in this section.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: Shall meet requirements of ASTM C 91.
- E. Mortar Cement: Shall meet requirements of ASTM C 1329.
- F. Aggregate for Grout: ASTM C 404.
- G. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Available Products:
 - a. Mortar Kick by Addiment Incorporated
 - b. Accelguard 80 by Euclid Chemical Company
 - c. Morset by Grace Construction Products, a unit of W. R. Grace & Co. - Conn.
 - d. Trimix-NCA by Sonneborn, Div. of ChemRex
 - e. Or Equal

- I. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 706, Grade 60.
- B. Masonry Joint Reinforcement, General: Shall meet the requirements of ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 1.7 or 0.148-inch diameter.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches on center.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. See specification section 042200 "Concrete Unit Masonry" for additional information.

2.7 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. See Specification section 042200 "Concrete Unit Masonry" for additional information.

- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Available Products:

- a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
- b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
- c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
- d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
- e. Or Equal

2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270 Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For reinforced and load bearing masonry, use Type S.

2.10 GROUT MIXES:

- A. Grout for Unit Masonry: Comply with ASTM C 476 for concrete (grout) for use in construction of reinforced and nonreinforced unit masonry with the following exceptions. No job site mixing will be allowed. No air-entraining admixture will be allowed. Provide a grout with a consistency at time of placement which will completely fill all spaces to receive grout.
1. Use grout of type indicated or, if not otherwise indicated, of type fine or coarse that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS for dimensions of grout spaces and pour height.
 2. Minimum 28 day compressive strength = 2,500 PSI.
 3. Maximum size of large aggregate shall not exceed 3/8" diameter for coarse grout if used. If grout is to be pumped then fine grout must be used.
 4. Concrete fill (grout) should be batched, mixed and delivered in accordance with ASTM C 94.
- B. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
- C. Do not lower the freezing point of grout by use of admixtures or antifreeze agents.
1. Do not use calcium chloride in grout.
- D. Sampling and testing of concrete fill (grout) should be per ASTM C 1019.
- E. Make a test set (3 per set) at the rate of 1 per each 20 cubic yards of grout or fraction thereof, being placed each day.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
 - 1. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602.

3.3 LAYING MASONRY WALLS

- A. See Specification section 042200 "Unit Masonry" for additional information.
- B. Bond Pattern for Reinforced or Load Bearing Masonry: Unless otherwise indicated, lay masonry in running bond; do not use units with less than nominal 8-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

- F. Fill cores in hollow concrete masonry units with grout a minimum of 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units in reinforced and load bearing walls as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

3.5 PLACING VERTICAL REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials that will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the normal bar diameter or 1" (whichever is greater).
- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1½ times the normal bar diameter or 1½", whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Engineer. Provide lapped splices unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Weld bars only where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- F. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover 5/8" on exterior face of walls and ½" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, off sets, column fireproofing, pipe enclosures and other special conditions.
- G. For Intersecting and Abutting Walls:
 - 1. At Reinforced or Load Bearing Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

- a. Provide individual metal ties not more than 16 inches on center.
 - b. Provide rigid metal anchors not more than 24 inches on center. If used with hollow masonry units, embed ends in mortar-filled cores.
2. At Non-Reinforced or Load Bearing Walls provide the following:
 - a. Provide expansion or control joints. See specification 042200 "Concrete Unit Masonry" for additional information.
 - b. Provide rigid metal anchors not more than 24 inches on center. If used with hollow masonry units, embed ends in mortar-filled cores.

3.6 MASONRY JOINT REINFORCEMENT

- A. In Reinforced or Load Bearing Masonry Walls provide the following:
 1. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 8 inches.
 - a. Space reinforcement not more than 16 inches on center.
 - b. Provide additional horizontal reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings. This reinforcement is in addition to continuous horizontal wall reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 REINFORCED CONCRETE MASONRY UNIT INSTALLATION

A. General:

1. Do not wet concrete masonry units (CMU).
2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.
3. Placing Reinforcement: Comply with requirements of ACI 530.1/Building Code Requirements for Masonry Structures.
4. Temporary Formwork and Shores: Construct formwork and shores to support reinforced elements during construction.
 - a. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
5. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - a. Comply with requirements of ACI 530.1/ Building Code Requirements for Masonry Structures, for cleanouts and for grout placement, including minimum grout space and maximum pour height.

B. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting:

1. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions or when pumping is to be used.
2. Use "Coarse Grout" per ASTM C 476 for filling 4" spaces or larger in both horizontal directions.
3. Grout Mix: ASTM C 476 Proportion Specifications. Measure proportions by volume:
 - a. "Fine Grout" shall be 1 part minimum Portland Cement to 1/10 part hydrated lime to 3 parts damp loose aggregate. (28 days compressive strength to be 2500 psi).
 - b. "Coarse Grout" shall be 1 part minimum Portland Cement to 1/10 hydrated lime to 2 parts damp loose aggregate. (28 day compressive strength to be 2500 psi).

D. Grouting Technique: At the Contractor's option, use low-lift grouting techniques subject to requirements that follow.

1. Low-Lift Grouting:

- a. Provide minimum clear dimension of 2" and clear area of 8 sq. in. In vertical cores to be grouted.
- b. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.
- c. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.
- d. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1½" below top course of pour.
- e. Stop grout in vertical cells 1½" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

E. Bond Beams: Stop grout in vertical cells 1 ½" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

1. Place horizontal beam reinforcement as the masonry units are laid.

F. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members

supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaching of mortar bond. Install shores and bracing, if required, before starting grouting operations.
2. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.
3. Limit grout pours to section that can be completed in one working day with not more than one-hour interruption of pouring operation. Place grout in lifts which do not exceed 5'-0". Allow not less than 30 minutes, or more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.
 - a. Place grout in lintels or beams over openings in one continuous pour.
4. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
5. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.9 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. Testing Frequency: Tests and evaluations listed below shall be performed by an independent testing laboratory during construction for each 1000 sq. ft. of wall area or portion thereof.
 1. If Statement of Compressive Strength of Masonry required in Section 1.4.G of this specification is not submitted; then the wall f'_m will have to be established in accordance with paragraph 2 below **AT CONTRACTOR'S COST**.
 2. Determination of Masonry Design Strength:
 - a. General. The value of f'_m shall be determined by tests of masonry assemblies in accordance with ASTM E 447 Prism Strength test or the combined tests of masonry, grout, and mortar, reference ACI 530.1 Section 1.6.
 - b. Tests:
 - 1) General. When the strength f'_m is to be established by tests, they shall be made using prisms built of the same materials, under the same conditions and, insofar as possible, with the same bonding arrangements as for the structure. The moisture content of the units at time of laying, consistency of mortar, and the workmanship shall be the same as will be used in the

structure. The value of f'_m shall be the average of all specimens tested but shall be not more than 125 percent of the minimum value determined by test, whichever is less.

Testing shall include tests in advance of beginning operations and at least one field test during construction per each 1000 square feet of wall but not less than three such tests for any wall.

The compressive strength f'_m shall be computed by dividing the ultimate load by the net area of the masonry used in the construction of the prisms.

- 2) Prisms. Prisms shall be not less than 12 inches high and shall have a height-to-thickness minimum dimensions ratio of not less than 1.5 or more than 5. Hollow masonry unit prisms shall be not less than one masonry unit in length and solid masonry unit prisms or solid filled prisms shall be not less than 4 inches in length. The thickness and type of construction of the specimen shall be representative of the masonry element under consideration. Cores in hollow masonry shall not be filled, except for solid filled construction. The strength f'_m shall be taken as the compressive strength of the specimens multiplied by the following correction factor:

Ratio of H/d	1.5	2.0	3.0	4.0	5.0
Correction Factor	0.86	1.00	1.20	1.30	1.37

WHERE:

h = height of specimen in inches.

d = minimum dimension of specimen in inches.

Intermediate values may be interpolated.

- 3) Storage of Test Prisms. Test prisms shall be stored for seven days in air, at a temperature of 70°, plus or minus 5°, in a relative humidity exceeding 90 percent, and then in air at a temperature of 70°, plus or minus 5°, at a relative humidity of 30 percent to 50 percent until tested. Those constructed in the field shall be stored undisturbed for from 48 to 96 hours under wet material to simulate 90 percent humidity, then transported to laboratory for continued curing as above. Prisms shall be capped and tested in compression similar to tests for molded concrete cylinders.
- 4) Sampling. Not less than five specimens shall be made for each initial preliminary test to establish f'_m . Not less than three shall be made for each field test to confirm that the materials are as assumed in the design. The standard age of test specimens shall be 28 days, but seven-day and 28-day strengths of the masonry is established by adequate test data for the materials used.

- B. Test results will be reported in writing from the testing agency to the Engineer and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project

identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

- C. Test reports shall be sent by laboratory within three days of testing and directly to the following:

One copy to Special Inspector
One copy to Architect
One copy to Structural Engineer
One copy to Contractor

- D. In the event test results do not meet specification requirements, the contractor will be responsible for the cost on one or both of the following tests:

1. Core boring test conforming to ASTM C-41.
2. Load test in accordance with Chapter 2 of ACI 318

In the event core-boring or load tests indicate that concrete does not conform to specifications, Contractor shall take such measures as Architect will prescribe or shall remove defective work as directed by Architect.

3.10 MASONRY INSPECTION

- A. The Contractor for the Work of this Section is responsible for all masonry inspections and reports as specified herein.
- B. Provide masonry construction inspection of concrete masonry walls indicated as requiring inspection on the Masonry Plans to insure that masonry construction is in conformance with the Contract Documents. Masonry inspection is required for those masonry elements which must be constructed to attain high design strengths, such as, but not limited to, vertically reinforced grouted CMU walls, grouted CMU wall, and load-bearing CMU walls.
- C. The individual or individuals who will perform the masonry inspection shall be present for the Pre-masonry Conference.
- D. The masonry inspector shall prepare a written report or reports for each day of inspection.
- E. The masonry inspector shall be present and observe all grouting operations in walls requiring inspection. The masonry inspector shall be present at the project site within sufficient time, in advance of grouting operations, to inspect the construction to insure its conformance to the contract Documents and that grouting may proceed. Periodically, the masonry inspector shall be present during the placing of masonry units and reinforcement. No grouting shall be permitted unless the masonry inspector is present and has indicated that the masonry construction is properly prepared for the grouting operation.

END OF SECTION 042100

MASONRY LEVEL 1 SPECIAL INSPECTION
KBC Table 1704.5.1

INSPECTION TASK	FREQUENCY OF INSPECTION		REFERENCE FOR CRITERIA		
	Continuous	Periodic	KBC Section	ACI 530	ACI 530.1
1. As masonry construction begins, the following shall be verified to ensure compliance:					
a. Proportions of site-prepared mortar.		X			Art. 2.6A
b. Construction of mortar joints		X			Art. 3.3B
c. Location of reinforcement and connectors.		X			Art. 3.4
2. The inspection program shall verify:					
a. Size and location of structural elements.		X			Art. 3.3G
b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.		X		Sec. 1.15.4, 2.1.2	
c. Specified size, grade, and type of reinforcement.		X		Sec. 1.12	Art. 2.4, 3.4
d. Welding of reinforcing bars.	X		2108.9.2.1 1 Item 2	2.1.8.6, 2.1.8.6.2	
e. Protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)		X	Sec. 2104.3, 2104.4		Art. 1.8
3. Prior to grouting, the following shall be verified to ensure compliance:					
a. Cleanliness of grout space.		X			Art. 3.2D
b. Placement of reinforcement and connectors.		X		Sec. 1.12	Art. 3.4
c. Proportions of site-prepared grout.		X			Art. 2.6B
d. Construction of mortar joints.		X			Art. 3.3B
4. Grout placement shall be verified to ensure compliance with code and construction document provisions.	X				Art. 3.5
5. Preparation of any required grout specimens, mortar specimens, and/or prisms shall be observed.	X		Sec. 2105.3, 2105.4, 2105.5		Art. 1.4
6. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.		X			Art. 1.5

References:

- KBC – Kentucky Building Code
- ACI 530 – American Concrete Institute, Building Code Requirements for Masonry Structures
- ACI 530.1 – American Concrete Institute, Specification for Masonry Structures

SECTION 042200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Embedded flashing.
 - 4. Masonry-cell insulation.
- B. Related Sections:
 - 1. Section 042100 "Reinforced Unit Masonry."

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- C. Samples for Initial Selection:
 - 1. Decorative CMUs, in the form of small-scale units.
 - 2. Colored mortar.
- D. Samples for Verification: For each type and color of the following:
 - 1. Decorative CMUs.
 - 2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 3. Accessories embedded in masonry.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for quality control testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- B. Do not apply uniform roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ACM Chemistries, Inc.; RainBloc.
 - 2) BASF Aktiengesellschaft; Rheopel Plus.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
- C. Decorative CMUs: ASTM C 90.
1. Basis-of-Design Products: Subject to compliance with requirements, provide the following or approved equal:
 - a. Type 1: Grand Blanc; "Boardman"
 - b. Type 2: Grand Blanc; "Bellagio"
 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 3. Density Classification: Lightweight.
 4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
 5. Pattern and Texture:
 - a. Standard pattern, ground-face finish.
 6. Colors: As selected by Architect from manufacturer's full range for final verification.

2.3 EMBEDDED FLASHING MATERIALS

- A. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
1. Products: Subject to compliance with requirements, provide the following or approved equal:
 - a. Mortar Net USA, Ltd.; Blok-Flash.

2.4 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Concrete Block Insulating Systems; Korfil.
- b. Shelter Enterprises Inc.; Omni Core.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 1. Interior Walls: Hot-dip galvanized, carbon steel.
 2. Exterior Walls: [Hot-dip galvanized, carbon] [Stainless] steel.
 3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
 4. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
- B. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.4 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: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to one story high.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.
- C. Install continuous except in cells to receive grout.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 - 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 FLASHING

- A. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.9 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 050020 – ADHESIVE (CHEMICAL) ANCHORS AND EXPANSION ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Documents affecting work of this Section include, but are not limited to, Conditions of the Contract and Sections in Division 1 of these Specifications.

1.2 SCOPE OF WORK

- A. This section covers adhesive anchors and expansion anchors to be installed in hardened concrete or hollow concrete masonry walls or grouted solid concrete masonry walls for connection of load-bearing and structural elements.

- 1.3 Adhesive anchors and expansion anchors shall be galvanized unless stainless steel is shown on drawings. See drawings for sizes and diameters.

1.4 SUBMITTALS

- A. Submit data sheets for any of the following: threaded inserts, anchor rods, adhesive anchor or expansion anchor to Engineer for approval at least four weeks in advance.

PART 2 - MATERIALS

- 2.1 Expansion Anchors: Wedge type anchors. See drawings for exact size, type and details.

- A. Products: Subject to compliance with strength requirements, provide one of the following:

“Hilti Anchor Systems”: Hilti, Inc., Tulsa, Oklahoma

“ITW Ramset/Redhead Products”: ITW Ramset/Redhead, Woodale, Illinois

“Simpson Strong-Tie Anchor System”: Simpson Strong-Tie Company, Inc., Dublin, California

Or equal

- 2.2 Adhesive Anchors: See also drawings for type, size, details, locations and any variations. Two-component adhesive chemical injection system with a threaded rod or insert, zinc plated to ASTM B 633 SCI, or 60 grade reinforcing bars. Provide screens for anchors in hollow masonry units.

- A. Products: Subject to compliance with strength requirements, provide one of the following:

“Hilti Anchor Systems”: Hilti, Inc., Tulsa, Oklahoma
“ITW Ramset/Redhead Products”: ITW Ramset/Redhead, Woodale, Illinois
“Simpson Strong-Tie Anchor System”: Simpson Strong-Tie Company, Inc., Dublin, California
Or equal

- 2.3 Stainless Steel: Grade 304 or 316
- 2.4 Galvanized Steel: Carbon steel bolts and nuts; hot-dip galvanized ASTM A153.
- 2.5 Flat Washers: ANSI B18.22.1; of the same material as bolts and nuts.

PART 3 - EXECUTION

3.1 EXPANSION ANCHORS

- A. Anchors used on this project must also meet or exceed the published loading capacities of the anchor system designated on the plans for each size and spacing, (i.e. shear and tension loads in the rods, bolts or inserts and the sheer and tension loads in the connection to the concrete) for both allowable and ultimate loading conditions. Concrete strength is 4000 psi at 28 days.
- B. Expansion anchors shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt hole diameters. Minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4-1/2 times the diameter of the hole in which the anchor is installed. Unless otherwise indicated on the drawings, the minimum distance between the centers of expansion anchors shall be at least 8 times the diameter of the hole in which the anchors are installed.
- C. Nuts and washers for expansion anchors shall be as specified for anchor bolts.
- D. Unless otherwise shown on drawings, install anchors normal to face of concrete; maximum tolerance or deviation shall not exceed six (6) degrees.

3.2 ADHESIVE ANCHORS

- A. Anchors used on this project must meet or exceed the published loading capacities of the anchor system designated on the plans for each size and spacing, (i.e. shear and tension loads in the rods, bolts or inserts and the sheer and tension loads in the connection to the concrete) for both allowable and ultimate loading conditions. Concrete strength is 4000 psi at 28 days.
- B. Adhesive anchors to be installed in holes drilled using the specified diameter of Hilti carbide-tipped drill bit (or matched tolerance Hilti DDB core bit) or appropriate Ramset drill

requirements. Note: ordinary core bits are not to be used with any Hilti HY 150 or HIT ICE adhesive anchors or Ramset Acrylic 7. Anchors shall be installed in strict accordance to manufacturer's instructions.

- C. **IMPORTANT:** Clean out all dust and debris. Use compressed air or vacuum at bottom of the hole. When using a Hilti matched tolerance diamond core bit, immediately remove standing water. Anchors shall not be disturbed until cure time has elapsed.
- D. Unless specifically shown otherwise on contract drawings, install anchors normal to face of concrete; maximum tolerance or deviation shall not exceed six (6) degrees.

3.3 ANCHORS FOR MASONRY

- A. In hollow concrete masonry units: HILTI HIT HY-20 Renovation Anchors, Hilti, Inc., Tulsa, Oklahoma; or Engineer approved equal.
- B. In solid or grouted masonry units: HILTI HY150 2-part epoxy anchoring system, Hilti, Inc., Tulsa, Oklahoma; or Engineer approved equal.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS (MISC. METALS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.
- B. Extent of metal fabrications is indicated on drawings and schedules.
- C. Types of work in this section include metal fabrications for:
 - Rough hardware
 - Water heater / pressure tank support
 - Loose bearing and leveling plates
 - Miscellaneous framing and supports
- D. Related Sections include the following:
 - 1. Division 5 Section 055000 "Metal Fabrications"
 - 2. Division 3 Section 033000 "Cast-In-Place Concrete"
 - 3. Division 4 Section 042100 "Reinforced Unit Masonry"

1.3 SYSTEM PERFORMANCES

- A. Structural Performances: Provide assemblies which, when installed, comply with the structural drawing requirements.
 - 1. Concentrated and Uniform Loads above need not be assumed to act concurrently.

1.4 QUALITY ASSURANCE

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Welding: Quality procedures and personnel according to the following:
 - 1. AWS D1.1 "Structural Welding Code – Steel".

1.5 SUBMITTALS

- A. Product Data: When requested by Architect/Engineer submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.
- B. Shop Drawings, General: All shop drawings submitted shall be a complete set of original drawings created by the Supplier. No partial or incomplete submittals nor duplication of Architect/Engineer's original documents will be permitted.
 - 1. All shop drawing submittals shall include 3 sets of prints for structural consultant to review and mark up. (Note number of prints may be increased if Architect/Engineer so directs at the Preconstruction Conference.) Shop Drawings shall be prepared by a professional engineer licensed to practice in Kentucky.
 - 2. Shop drawings must not only bear the Contractor's stamp of approval but shall also show evidence that each item has been thoroughly checked. Failure to comply with this requirement shall result in the Engineer's return of the submission (without review or action) for the Contractor's proper submission and review. No exceptions shall be taken.
 - 3. Copies of shop drawings used in the field shall contain review stamp by the Engineer to be used in connection with the work.
 - 4. Minimum Requirements for Electronically Submitted Structural Shop Drawings:
 - a. No partial submittals will be accepted. Submittal will be returned without review.
 - b. No incomplete submittals will be accepted.
 - c. Submittal must include:
 - 1) One hard copy of both erection drawings and piece drawings.
 - 2) Hard copy must have been reviewed and noted as such by general contractor/construction manager.
 - 3) All piece marks must be on erection drawings.
 - 4) All elements of the erection drawings must be named and in piece drawings.
 - 5) A list of drawings submitted must be enclosed.
 - 6) Submitted drawing must be in PDF format.

1.6 Coordination

- A. Coordinate installation of metal fabrications with other work prior to fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ferrous Metals:
 - 1. Metal Surfaces, General: For fabrication of miscellaneous metal which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Plates, Shapes and Bars: ASTM A 36.
- B. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
 1. Size of Channels: 1-5/8 by 1-5/8 inches and as indicated.
 2. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, or structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
 - a. Application: All slotted channel framing concealed from view.
 3. Material: Steel complying with ASTM A 1008/A 1008M, commercial steel, Type B, or structural steel, Grade 33; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
 - a. Application: All slotted channel framing exposed to view.
 - b. Color: Match Architect's sample; medium metallic silver.
- C. Grout:
 1. Metallic Non-Shrink Grout: Pre-mixed, factory-packaged, ferrous aggregate grout complying with CE CRD-C588, Type M.
 2. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CD CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
- D. Fasteners:
 1. Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
 2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.
 3. Wood Screws: Flat head carbon steel, FS FF-S-111.
 4. Plain Washers: Round, carbon steel, FS FF-W-92.
 5. Lock Washers: Helical sprint type carbon steel, FS FF-W-84.
- E. Paint:
 1. See Division 9 for primer and finish coat paint specification.
 2. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with the Military Specifications MIL-P21035 (Ships) or SSPC-Paint-20.

2.2 FABRICATION GENERAL

- A. Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for intended use. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated.
- C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, phillips flat-head (countersunk) screws or bolts.
- E. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Galvanizing: Unless otherwise required, protect ties, anchors, rolled, pressed and forged steel shapes, plates, bars and strips 1/8" thick or heavier not meeting the requirements of stainless steel by galvanizing in conformance with the following:
 - 1. Anchors, Shapes, Plates, Bars, and Strips on columns completely embedded: ASTM A 153 (1.50 oz./ft.2)
- G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- H. Shop Painting
 - 1. Apply shop primer to surfaces of metal fabrications except those which are galvanized or as indicated to be embedded in concrete or masonry, unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.
 - 2. Stripe paint all edges, corners, crevices, bolts, welds and sharp edges.
- I. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirement indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".
 - 2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

2.3 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for

anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.4 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide [**Type 304**] [**Type 316**] stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- A. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy **Group 1**.
- B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- C. Anchors, General: Anchors capable of sustaining, 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 by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- D. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- E. Post-Installed Anchors: **Chemical anchors**.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **Group 1** stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- F. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

- A. General:
 1. Fastening to In-Place Construction: Provide anchorages devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry insert, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.
 2. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
 3. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and tough-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
 4. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

5. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
6. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with grout. Use metallic no-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
7. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING SLOTTED CHANNEL FRAMING

- A. Install slotted channel framing according to manufacturer's written instructions.
- B. Anchor slotted channel framing to existing construction with anchors and fasteners necessary to support imposed loads and provide proper performance and appearance.
- C. Connect slotted channel framing members together to configuration shown on Drawings and necessary for proper function, performance, and appearance, using connectors, brackets, and fasteners recommended by manufacturer and suitable for application.

3.4 ADJUST AND CLEAN

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. Types of work in this section include Rough Carpentry for:
 - 1. Wood Framing.
 - 2. Wood grounds, nailers and blocking.
 - 3. Wood furring.
 - 4. Roof sheathing.
 - 5. Engineered wood products
- B. Miscellaneous carpentry is specified in another section(s) within Division 6.
- C. Roofing is specified in Division 7 section.
- D. Drywall is specified in a Division 9 section.

1.3 DEFINITIONS

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for materials listed below:
- B. Materials Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

- C. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation.
 - 1. Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.
 - 2. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
 - 3. Fire-Retardant Treatment: Include certification by treating plant that treating material complies with specified standard and other requirements.

1.5 PRODUCT HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 - 1. For lumber and plywood pressure treated with water-borne chemicals, sticker between each course to provide air circulation.

1.6 PROJECT CONDITIONS

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Fire-Retardant Treated Wood: Obtain each type of fire-retardant treated wood product through one source from a single producer.
- C. Environment Quality Assurance:
 - 1. New Dimensional Lumber – Certified: Certified to be from a well-managed forest, by one or more of the following independent certification organizations accredited by the Forest Stewardship Council:
 - a. Scientific Certification Systems, Inc., Oakland, California.
 - b. Smart Wood Certification Program: Rainforest Alliance, New York, New York.

2. New Dimensional Lumber – Non-Certified: Select lowest grade that meets performance requirements.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Manufacture lumber to comply with DOC PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:
 1. SPIB - Southern Pine Inspection Bureau
 2. WWPA - Western Wood Products Association
 3. APA - American Plywood Association
- C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
 1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 1. Provide dressed lumber, S4S, unless otherwise indicated.
 2. Provide seasoned lumber with 19 percent (19%) maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2.2 DIMENSION LUMBER

- A. For structural light framing (2" to 4" thick, 2" to 4" wide) provide the following grade and species:
 1. No. 2 grade.
 2. Same species as indicated for structural framing grade below.
- B. For structural framing (2" to 4" thick, 5" and wider) provide following grade and species:
 1. Any species of No. 2 grade which meets or exceeds the following values:

- a. Fb (minimum extreme fiber stress in bending); 1500 psi
- b. E (minimum modulus of elasticity); 1,600,000 psi

2.3 BOARDS

- A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
 1. Moisture Content: 19 percent maximum, "S-DRY".
 2. Where transparent or natural finish for exterior applications, or no finish is indicated, provide Redwood, Select Heart Grade (RIS).
 3. Where painted finish is indicated for interior use, provide No. 1 Boards per SPIB rules, Select Merchantable Boards per WCLIB rules or No. 2 Common Boards and Better per SSPA rules.
- B. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY).

2.4 MISCELLANEOUS LUMBER

- A. Provide work for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
 1. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

2.5 ENGINEERED WOOD PRODUCTS

- A. Exposed to weather engineered wood products acceptable to authorities having jurisdiction and with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.
- B. Parallam Plus PSL or equal with preservative moisture protection and the following criteria: Service level = SL2, AWP = UC3B.
 1. Allowable Extreme Fiber Stress in Bending: 1827 psi
 2. Modulus of Elasticity: 1,460,000 psi.
- C. Refer to Section 099113 for exterior finish.

2.6 CONSTRUCTION PANELS (Roof Sheathing)

1. 3/4" nominal – fire treated plated plywood, 48/24 APA rated sheathing EXP 1 C/D, 4 ply.
2. Edge Detail: Panel clips, tongue and groove edges, or lumber blocking between trusses.

2.7 MISCELLANEOUS MATERIALS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
- H. Building Paper: ASTM D 226, Type I; asphalt saturated felt, non-perforated, 15-lb type.

2.8 WOOD TREATMENT BY PRESSURE PROCESS

- A. Preservative Treatment: Lumber and plywood shall be "Treated", and shall comply with applicable requirements of AWPB Standards C2 (Lumber) and C9 (Plywood) and of AWPB standards listed below. Mark each treated item with the AEPB Quality Mark Requirements.
 - 1. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, or 19 percent and 15 percent. Treat indicated items and the following:
 - a. Nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - b. Wood sills, sleepers, blocking furring, stripping and similar concealed members in contact with masonry or concrete
 - c. Wood framing members less than 18" above grade.
 - d. Wood floor plates installed over concrete slabs directly in contact with earth.
 - 2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment

and to comply with AWP A M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

- B. Fire-Retardant Treatment: Where fire-retardant treated wood ("FRTW") is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWP A C20 and C27, respectively, for treatment type indicated below; identify "FRTW" lumber with appropriate classification marking of Underwriters Laboratories, Inc. U.S. Testing, Timber Products Inspection or other testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Interior Type A: Use where "FRTW" wood is indicated for interior applications.
 - 2. Exterior Type: Use where "FRTW" wood is indicated for exterior, exposed application.
 - 3. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true and cut and fitted.
- C. Securely attach carpentry work to substrate to anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of work; predrill as required.
- E. Separate treated lumber from metal finishes with felt or other breaker material.

3.2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

- C. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to brick face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.3 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
 - 1. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or incombustible materials, accurately fitted to close furred spaces.
- B. Furring to Receive Gypsum Drywall: Unless otherwise indicated, provide 2" x 2" furring at 16" o.c., vertically.
- C. Furring to Receive Plaster Lath: Unless otherwise indicated provide 1" x 2" furring at 16" o.c., vertically.
- D. Install plywood backing panels by fastening to CMU; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

3.4 WOOD FRAMING, GENERAL

- A. Provide framing members of sizes and on spaces shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association (N.F.P.A.). Do not splice structural members between supports.
- B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.

3.5 INSTALLATION OF ROOF SHEATHING

- A. Fastening Methods: Fasten panels as indicated below:
 - 1. Roof Sheathing: Nail to framing with #10d common or galvanized nails: 6" on center along supported panel edges and 12" on center at intermediate supports. Spacing of 1/8" is required at all panel ends and edges. Install with the long dimension or strength axis of the panel across supports, and with panel continuous over two or more spans. Suitable edge support shall be provided by use of panel clips (H-clips), tongue-and-groove edges, or lumber blocking between trusses. Panel end joints shall occur over framing.

END OF SECTION

SECTION 061753 – PREFABRICATED DIMENSIONAL WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Prefabricated wood trusses include planar structural units consisting of metal plate connected members which are fabricated from dimension lumber and which have been cut and assembled prior to delivery to the job site.
 - 1. Types of prefabricated wood trusses include:
 - a. Gable and hip shaped trusses.
 - b. Monopitch trusses.
 - c. Parallel chord wood trusses.
- B. Truss to truss connectors and hangers shall be designed and furnished by the truss manufacturer.
- C. Roof Sheathing is specified with rough carpentry in another Division-6 section.
- D. Related Sections: Section 014110 “Structural Test and Special Inspection”

1.3 SUBMITTALS

- A. Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment, handling and erection.
 - 1. Submit certificate, signed by an officer of fabricating firm, indicating that trusses, truss components and truss connectors/hangers to be supplied for project comply with indicated requirements.
- B. Shop Drawings, General: All shop drawings submitted shall be a complete set of original drawings created by the Supplier. No partial or incomplete submittals or duplication of Engineer's or Architect's original documents will be permitted.
 - 1. All shop drawing submittals shall include 3 sets of prints for structural consultant to review and mark up. (Note number of prints may be increased by Architect/Engineer at the Preconstruction Conference.)
 - 2. Shop drawings must not only bear the Contractor's stamp of approval but shall also show evidence that each item has been thoroughly checked. Failure to comply with this

- requirement shall result in the Engineer's return of the submission (without review or action) for the Contractor's proper submission and review. No exceptions shall be taken.
3. Copies of shop drawings used in the field shall bear the Engineer's and Architect's review stamp with items checked to indicate a satisfactory final review.
- C. Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design value, and location of metal connector plates; bearing and anchorage details, and bracing requirements.
1. To the extent engineering design considerations are indicated as fabricator's responsibility, submit design analysis and test reports indicating loading, section modulus, assumed allowable stress, stress diagrams and calculations, and similar information needed for analysis and to ensure that trusses, truss components and truss connectors/hanger comply with requirements.
 2. Provide shop drawings which have been signed and stamped by a structural engineer licensed to practice in the state where project is to be constructed.
- D. Submit bottom chord and web permanent bracing sizes and locations.
- E. All submittals in compliance with Section 014000, Quality Requirements.

1.4 QUALITY ASSURANCE

- A. Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:
1. "Design Specification for Metal Plate Connected Wood Trusses".
 2. "Design Specification for Metal Plate Connected Parallel Chord Wood Trusses".
 3. "Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses" (BCSI- 1-03).
- B. Comply with applicable requirements of "National Design Specification for Wood Construction" published by AF & PA.
- C. Comply with PS20 and with applicable rules of the respective grading inspecting agencies for species and grade of lumber indicated.
- D. Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Control Manual".
- E. Provide trusses by a firm which as a record of successfully fabricating trusses similar to type indicated and which complies with the following requirements for quality control:
1. Fabricator practices a quality control program which complies with, or is comparable to, one published in TPI "Quality Control Manual" and which involves inspection by an

independent inspection and testing agency acceptable to Architect/Engineer and authorities having jurisdiction.

- F. Provide metal connector plates from a single manufacturer.
- G. Basis-of-Design: Standard truss connectors/hangers shall comply with Simpson Strong-tie Co., Inc. or approved equal.
 - 1. Special Truss connectors/hangers shall be designed to meet current AISC, AISI and NFPA standards.
- H. Special Inspections
 - 1. The Truss Manufacturer is to submit all necessary paperwork or hire a Special Inspector to meet the requirements for Special Inspection of fabricators listed in Chapter 17 of the 2007 KBC, Section 1704.2.
- I. Erection per BCSI 1-03 publication, produced jointly by Wood Truss Council of America and Truss Plate Institute.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.
- B. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering metal connector plates which may be incorporated in the work include, but are not limited to, the following:

- Alpine Engineered Products, Inc.
- Clary Corporation
- Gang Nail Systems, Inc.
- Hydro-Air Engineering, Inc.
- Inter-Lock Steel Co., Inc.
- Link-Wood Construction Systems
- Lumbermate Company
- Robbins Manufacturing Co.
- The Panel-Clip Company
- Structomatic, Inc.

Simpson
Tee-Lok Corp.
Truss Connectors of America
Truswall Systems Corp.
Woodco Ltd.

2.2 LUMBER

- A. Factory mark each piece of lumber with type, grade, mill and grading agency.
- B. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for dressed lumber, S4S, unless otherwise indicated.
 - 1. Provide seasoned lumber with a maximum moisture content at time of dressing of 15%.
- C. Lumber Species: Douglas Fir, Hem-Fir, Western Larch graded by WWPA or WCLIB; or Southern Pine, graded by SPIB; at Fabricator's option.
- D. Lumber Grade: For species indicated, provide the minimum following stress-rated grade:
 - 1. Grade: Any grade of lumber fulfilling requirements indicated for species, stress ratings, and moisture content.
- E. Stress Rating: Provide lumber which has been graded or tested and certified, at indicated moisture content, to be in compliance with stress ratings shown on drawings.

2.3 METAL CONNECTOR PLATES, CONNECTORS/HANGERS, FASTENERS AND ANCHORAGES

- A. Connector Plate Material: Metal complying with following requirements, unless otherwise indicated; not less than "0.036" thick, coated thickness.
 - 1. Galvanized Sheet Steel: ASTM A 446, Grade A, Coating G60.
 - 2. Electrolytic Zinc Coated Steel Sheet: ASTM A 591, Coating Class C, with minimum structural quality equivalent to ASTM A 446, Grade A.
 - 3. Stainless Steel: ASTM A167, Type 304, with minimum structural quality equivalent to ASTM A 446, Grade A.
- B. Provide Standard connectors/hangers to comply with Simpson Strong-tie Co., Inc. or equal. Special Hangers that are not available from Simpson Strong-tie Co., Inc. (or equal) shall be designed to meet appropriate design codes and design shall be performed by a qualified registered professional engineer licensed in the state where the trusses are erected.

- C. Fasteners and Anchorages: Provide size, type, material and finish indicated, complying applicable Federal Specifications for nails, screws, bolts, nuts and washers and anchoring devices.

2.4 WOOD TREATMENT

- A. Kiln-dry lumber after treatment to a moisture content of 19% or less.
- B. Inspect each piece of treated lumber after drying and discard damaged or defective pieces.

2.5 FABRICATION

- A. Cut truss members to accurate lengths, angles and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.
- B. Fabricate metal connector plates to size, configuration, thickness and anchorage details required for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.
- D. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by means indicated or approved.

PART 3 - EXECUTION

3.1 GENERAL/QUALITY CONTROL

- A. Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute and The Wood Truss Council of America publication BCSI 1-03.
- B. Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.
- C. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.
- E. Anchor trusses securely with wind anchors at all bearing points to comply with methods and details indicated.

- F. Provide Simpson Strong-Tie (or equal) type hangers for all truss to truss and rafter to truss connections. Use proper size hanger to support design loads as indicated.
- G. Install truss connectors/hangers at the time trusses are erected.
- H. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.
- I. Do not cut or remove any truss members.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

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. Cold-applied, cut-back-asphalt dampproofing.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for retaining wall.
 - 2. Section 042200 "Concrete Unit Masonry" for mortar parge coat on masonry surfaces.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. APOC, Inc.; a division of Gardner-Gibson.
 - 2. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
 - 3. Brewer Company (The).
 - 4. ChemMasters, Inc.
 - 5. Euclid Chemical Company (The); an RPM company.
 - 6. Henry Company.
 - 7. Karnak Corporation.
 - 8. Koppers Inc.
 - 9. Malarkey Roofing Products.
 - 10. Meadows, W. R., Inc.
- B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.

- C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
 - 1. Primer 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."
- D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- E. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 - 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection below grade.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

(Building foundation and retaining walls where grade is higher than opposite side of wall)

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).

3.5 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 072100 - THERMAL INSULATION

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. Glass-fiber blanket insulation.
 - 2. Foam-plastic board insulation.
 - 3. Vapor retarders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.

2. Type VI, 40 psi (276 kPa).

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. CertainTeed Corporation.
 2. Guardian Building Products, Inc.
 3. Johns Manville.
 4. Knauf Insulation.
 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively, per ASTM E 84.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Raven Industries Inc.; DURA-SKRIM 2FR.
 - b. Reef Industries, Inc.; Griffolyn T-55 FR.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 073113 - ASPHALT SHINGLES

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. Asphalt shingles.
 - 2. Underlayment.
- B. Related Sections:
 - 1. Division 6 Sections for roof sheathing.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings, and flashings.

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of asphalt shingle, ridge and hip cap shingles, and ridge vent indicated.
 - 1. Include similar Samples of trim and accessories involving color selection.
- C. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
 - 1. Asphalt Shingle: Full size.
 - 2. Ridge Vent: 12-inch- (300-mm-) long Sample.
 - 3. Self-Adhering Underlayment: 12 inches (300 mm) square.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- C. Research/Evaluation Reports: For each type of asphalt shingle required, from the ICC.
- D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft (9.3 sq. m) of each type, in unbroken bundles.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain ridge and hip cap shingles ridge vents, felt underlayment, and self-adhering sheet underlayment from single source from single manufacturer.
- C. Fire-Resistance Characteristics: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 - 2. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first five years nonprorated.
 - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 60 mph (27 m/s) for five years from date of Substantial Completion.
 - 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.
- B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Three-Tab-Strip, SBS-Modified Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing; complying with UL 2218, Class IV.
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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed; XT30 Shingles or comparable product by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Malarkey Roofing Products.
 3. Strip Size: Manufacturer's standard.
 4. Algae Resistance: Granules treated to resist algae discoloration.
 5. Color and Blends: As selected by Architect from manufacturer's full range.

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type I, asphalt-saturated organic felts, nonperforated.
- B. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied.
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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed; Winterguard or comparable product by one of the following:
 - a. ALCO-NVC Inc.
 - b. Atlas Roofing Corporation.
 - c. Carlisle Coatings & Waterproofing, Inc.
 - d. GAF Materials Corporation.
 - e. Henry Company.
 - f. IKO.
 - g. Johns Manville.
 - h. Owens Corning.

2.3 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent; for use under ridge shingles.
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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Air Vent Inc.; Shinkle Vent II Class A or comparable product by one of the following:
 - a. Cor-A-Vent, Inc.
 - b. GAF Materials Corporation.
 - c. Lomanco, Inc.
 - d. Mid-America Building Products.
 - e. Obdyke, Benjamin Incorporated.
 - f. Owens Corning.
 - g. RGM Products, Inc.
 - h. Trimline Building Products.
 3. Minimum Net Free Area: As shown on drawings.

4. Width: 9".

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 077100 "Roof Specialties."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Single-Layer Felt Underlayment: Install on entire roof deck parallel with and starting where self-adhering underlayment is called for. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.
 2. Install fasteners at no more than 36 inch (900 mm) o.c.
- C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
 1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 2. Eaves: Extend from edges of eaves 36 inches (914 mm) beyond interior face of exterior wall.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 077100 "Roof Specialties."

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch (13 mm) over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- E. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
- F. Fasten asphalt shingle strips with the minimum of roofing nails located according to manufacturer's written instructions and/or as required by the building code.
 - 1. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.
- G. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- H. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner>.
 - 2. Address: <Insert address>.
 - 3. Building Name/Type: <Insert information>.
 - 4. Address: <Insert address>.
 - 5. Area of Work: <Insert information>.
 - 6. Acceptance Date: <Insert date>.
 - 7. Warranty Period: <Insert time>.
 - 8. Expiration Date: <Insert date>.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding 60 mph (m/sec);
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

END OF SECTION 073113

SECTION 074600 - SIDING

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. Fiber-cement soffit.
 - 2. Soffit vents.
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Division 6 Sections.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include material descriptions and finishes.
- B. Samples for Initial Selection: For soffit including related accessories.
- C. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.
 - 2. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

1.4 QUALITY ASSURANCE

- A. Labeling: Provide fiber-cement soffitt that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Source Limitations: Obtain soffit, including related accessories, from single source from single manufacturer.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for soffitt including accessories.
 - a. Size: 48 inches (1200 mm) long by 60 inches (1800 mm) high.
 - b. Include outside corner on one end of mockup.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weathertight place.

1.6 COORDINATION

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

1.7 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace soffit that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - 2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SOFFIT

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Soffit Panels, Non-vented, Smooth or comparable product by one of the following:
 - a. Cemplank.
 - b. CertainTeed Corp.
 - c. GAF Materials Corporation.
 - d. James Hardie.
- B. Pattern: Smooth texture.
- C. Factory Priming: Manufacturer's standard acrylic primer.

2.2 ACCESSORIES

- A. Fasteners:
 - 1. For fastening to wood, use pan head screw of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
 - 2. For fastening fiber cement, use stainless-steel fasteners.
- B. Insect Screening for Soffit Vents: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh.
- C. Continuous Soffit Vents: Basis of Design; Air Vent, Inc.; Continuous soffit vent.
 - 1. Material: Aluminum.
 - 2. Net-Free Area: 8 sq. in./linear ft. (560 sq. cm/m).
 - 3. Finish: Paintable.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Comply with soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Center nails in elongated nailing slots without binding siding to allow for thermal movement.
- B. Install fiber-cement soffit and related accessories.
 - 1. Install fasteners no more than 24 inches (600 mm) o.c.
 - 2. Install continuous soffit vent.
- C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 074600

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed fascia sheet metal fabrications.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section Section 077100 "Roof Specialties" for materials and installation of sheet metal flashing and trim integral with roofing.
3. Division 6 Sections.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include sections and attachment details.
2. Detail fabrication and installation layouts and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches (1:5).

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect from manufacturer's full range.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- I. Bond Breaker: Provide felt bond breaker between metal and treated lumber.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
 - D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
 - F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
 - H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 - I. Do not use graphite pencils to mark metal surfaces.
- 2.5 FORMED FASCIA SHEET METAL FABRICATIONS
- A. Flashing: Fabricate fascia trim over wood framing from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 20 gage (.0359 inches) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.

- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws and substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

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. Roof-edge drainage systems.
2. Preformed flashing sleeves.
3. Pre-manufactured drainage boots.

B. Related Sections:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
4. Section 079500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C) material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 3. Details of termination points and assemblies, including fixed points.
 4. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- D. Samples for Verification: For roof-edge drainage systems and preformed flashing sleeves made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 WARRANTY

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

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
1. Surface: Smooth, flat finish.
 2. Mill Finish: As manufactured.
 3. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - b. Three-Coat Fluoropolymer: AAMA 620. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - c. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.

3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- G. Pre-Manufactured Drainage Boots: Basis-of-Design is Zurn, 4x3, Z192 Downspout Boot or approved equal. Confirm opening size with downspout.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
1. Andreas Renner KG.
 2. Architectural Products Company.
 3. ATAS International, Inc.
 4. Berger Building Products, Inc.
 5. Castle Metal Products.
 6. Cheney Flashing Company.
 7. CopperCraft by FABRAL; a Euramax company.
 8. Hickman Company, W. P.
 9. Klauer Manufacturing Company.
 10. Merchant & Evans, Inc.
 11. Metal-Era, Inc.
 12. Metal-Fab Manufacturing, LLC.
 13. MM Systems Corporation.
 14. National Sheet Metal Systems, Inc.
 15. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
- C. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.040 inch (1.02 mm) thick.
 2. Gutter Profile: Style F according to SMACNA's "Architectural Sheet Metal Manual."
 3. Corners: Factory mitered and continuously welded or mechanically clinched and sealed watertight.
 4. Gutter Supports: Straps with finish matching the gutters.
- D. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.040 inch (1.02 mm) thick.
- E. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.4 PREFORMED FLASHING SLEEVES

- A. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Custom Solution Roof and Metal Products.
 - b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - c. Thaler Metal USA Inc.
 3. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
 4. Height: 13 inches (330 mm).
 5. Diameter: Size to fit penetration through roof.
 6. Finish: Black.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. Provide 1" round over-flow ports 4" above boots.
 - 1. Connect downspouts to boots and into underground drainage system indicated.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

B. Related Sections:

1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 092900 "Gypsum Board" for sealing perimeter joints.
3. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.
4. Section 083313 "Coiling Counter Doors" for sealing joints in frames.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION 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 kind 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. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction 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.
- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test 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.

1.7 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. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish 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: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 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 MATERIALS, GENERAL

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

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; 895.
 - c. Tremco Incorporated; Spectrem 3.

- B. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 898.
 - b. Or approved equal.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:
 - a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
 - b. Tremco Incorporated; **Vulkem 921**.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type O (open-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Soffits.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors and coiling counter doors.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Soffit panels.
 - g. Between plumbing fixtures and substrate.
 - h. Other joints as indicated, or required for weather-tight or water-tight assembly.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry walls.
 - d. Perimeter joints between interior wall surfaces and frames of doors and coiling counter doors.
 - e. Other joints as indicated.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Sealant Location:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated.
2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Atlas Metal Products.
 - 2. Corbin Metal Products.
 - 3. Curries Company; an Assa Abloy Group Co.
 - 4. Steelcraft; an Ingersoll-Rand Co.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.4 MATERIALS

- A. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- D. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- E. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Grout Guards: Weld guards to frame at back of hardware mortises. Frames are to be grouted.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 6. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

- b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. In-Place Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Access Panel Solutions, Inc.; Banco-Softline.
- C. Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 - 1. Acudor Products, Inc.
 - 2. Alfab, Inc.
 - 3. Babcock-Davis.
 - 4. Cendrex Inc.
 - 5. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
 - 6. Jensen Industries; Div. of Broan-Nutone, LLC.
 - 7. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 8. Karp Associates, Inc.
 - 9. Larsen's Manufacturing Company.
 - 10. Maxam Metal Products Limited.
 - 11. Metropolitan Door Industries Corp.
 - 12. MIFAB, Inc.
 - 13. Milcor Inc.
 - 14. Nystrom, Inc.
 - 15. Williams Bros. Corporation of America (The).
- D. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- E. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Access Panel Solutions, Inc.; Banco Softline.
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and ceiling.
4. Door Size: Size ceiling access door to fit between wood trusses, field verify dimensions. (1'10" x 3'0"). Wall access door size shall be 24" x 24" and located in CMU walls.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage.
 - a. Finish: Factory finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

F. Hardware:

1. Lock: Cylinder.

2.2 MATERIALS

- A. Galvanized Steel Panels.
- B. Frame Anchors: Same type as door face.
- C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083313 - COILING COUNTER DOORS

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. Exterior rated and insulated counter doors and frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, and furnished accessories.
 - 3. Include description of automatic closing device and testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Show locations of controls, locking devices, and other accessories.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats.
 - 2. Bottom bar.
 - 3. Guides.
 - 4. Brackets.
 - 5. Hood.
 - 6. Stainless steel counter panel product for each type, color, pattern, and surface finish.
 - 7. Locking device(s).
 - 8. Include similar Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
 - 1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell Iron Works, Inc.; counter door with integral frame and sill or comparable product by one of the following:
 - a. ACME Rolling Doors.
 - b. Alpine Overhead Doors, Inc.
 - c. Alumatec Pacific Products.
 - d. Amarr Garage Doors.
 - e. C.H.I. Overhead Doors.
 - f. City-Gates.
 - g. Clopay Building Products.
 - h. Cookson Company.
 - i. Lawrence Roll-Up Doors, Inc.
 - j. McKeon Rolling Steel Door Company, Inc.
 - k. Metro Door.
 - l. Overhead Door Corporation.
 - m. QMI Security Solutions.
 - n. Raynor.
 - o. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Stainless steel.
- D. Door Curtain Slats: Flat profile slats of 1-1/2-inch (38-mm) center-to-center height.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.
- F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings.
- G. Hood: Stainless steel.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- H. Integral Frame, Hood, and Fascia: Stainless steel.
 - 1. Mounting: Face of wall.
- I. Sill Configuration: Integral stainless steel sill.
- J. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside only, with cylinder.

- K. Manual Door Operator: Push-up operation.
- L. Curtain Accessories: Equip door with weatherseals, push/pull handles, and pull-down strap.
- M. Door Finish:
 - 1. Stainless-Steel Finish: No. 4 (polished directional satin).
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm); and as required.
 - 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 - 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
 - 1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.4 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
 - 1. Stainless Steel: Type 304, complying with ASTM A 666.

2.5 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Cylinders to match Section 087100 "Door Hardware" and keyed to building keying system.
 - 2. Keys: Three for each cylinder.

2.6 CURTAIN ACCESSORIES

- A. Weatherseals: Equip door with weather-stripping gaskets fitted to entire perimeter of door for air-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use Manufacturer's standard weatherseal.

- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches (2130 mm) high.

2.7 COUNTER DOOR ACCESSORIES

- A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf (111 N).

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and manual operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter. Apply sealant as required for weather-tight assembly.

3.4 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include periodic preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

END OF SECTION 083313

SECTION 083613 - SECTIONAL DOORS

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 pre-finished, insulated manually operated sectional doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
- B. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.
- C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Flat door sections.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: One year from date of Substantial Completion.

- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
 - 2. Testing: According to ASTM E 330[or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa) wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

- A. Galvanized Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 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:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Insulated Sectional Steel Door (432) or comparable product by one of the following:
 - a. Amarr Garage Doors.
 - b. Arm-R-Lite.
 - c. C.H.I. Overhead Doors.
 - d. Clopay Building Products.
 - e. Fimbel Architectural Door Specialties.
 - f. Haas Door.
 - g. Harmann LLC.
 - h. Martin Door Manufacturing.
 - i. Raynor.
 - j. Rite-Hite Corporation.
 - k. Wayne-Dalton Corp.
 - l. Windsor Door.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

- C. Installed R-Value: 7.35.
- D. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) zinc coating.
 - 1. Section Thickness: 24 gauge.
 - 2. Insulation: per manufacturer
 - 3. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of manufacturer's recommended dimension to comply with performance requirements.
- E. Track Configuration: Standard-lift track.
- F. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- G. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides, locking bars, operable from outside, with cylinders.
- H. Counterbalance Type: Torsion spring.
- I. Manual Door Operator: Push-up operation.
 - 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 2. Operator Type: Manufacturer's standard for door requirements.
- J. Door Finish:
 - 1. Baked-Enamel or Powder-Coat Finish: Color and gloss as selected by Architect from manufacturer's full range.
 - 2. Factory Prime Finish: Manufacturer's standard color.
 - 3. Finish of Interior Facing Material: Finish as indicated by manufacturer's designations.

2.4 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
 - 1. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
 - 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- (1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- (1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.
- D. Provide reinforcement for hardware attachment.
- E. Interior Facing Material: Manufacturer's standard material complying with the acceptance criteria of DASMA 107, with indicated thickness.
- F. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.5 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete

system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.

1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 (Z180) zinc coating.
 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
 3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.
 - a. For Vertical Track: Intermittent, jamb brackets attached to track and attached to wall.
 - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.6 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.
- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: Cylinders specified in Section 087100 "Door Hardware" standard with manufacturer and keyed to building keying system.
 2. Keys: Three for each cylinder.

2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 feet (4.88 m) long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.

- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches (610 mm) apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 087100 DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY:

A. Furnish and deliver all items of finish hardware required to adequately trim and hang all doors, also hardware as specified and as enumerated in “Set Numbers” and as indicated and required by actual conditions at the building. The hardware shall include the furnishing of all necessary screws, bolts, special bolts, expansion shields and other devices necessary for the proper application of the hardware.

B. RELATED SECTIONS:

The following items are covered in other sections:

1. Division 06; Rough Carpentry
2. Division 08; Metal Doors and Frames
3. Division 08; Access Doors
4. Division 08; Coiling Counter Doors
5. Division 08; Sectional Doors

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets.

1. Overhead Doors (except cylinders where scheduled)
2. Cabinets of all kinds, including open wall shelving and locks.
3. Toilet accessories of all kinds including grab bars.

1.02 SUBMITTALS:

A. Schedules:

The finish hardware supplier shall, upon award of the contract, furnish six (6) copies of a completely detailed schedule of finish hardware in “Vertical Format” in the Door and Hardware Institute’s Sequence and Format for approval within 30 days. Hardware schedule to be complete with Title page, Door Index/Keying Schedule and Manufactures legend. After “Approval” provide six (6) copies, unless otherwise requested, of the corrected, revised and approved schedule for field use, distribution and files. Provide one (1) copy complete with Catalog Cuts, marked “Installers Copy” and deliver it to the job site. Horizontal format schedules will be rejected.

B. Product Data:

Provide a catalog cut, clearly marked and identified, illustrating and describing each product included in the hardware schedule. Formulate these catalog cuts into sets and include a set with each copy of the hardware schedule submitted.

C. Samples:

If so requested by the Architect, provide a sample of any product or item requested, properly marked and tagged, for the opening for which it is intended. After examination and approval by the Architect, the sample shall be turned over to the General Contractor, for incorporation into the project.

D. Templates:

Upon “Approved” copies of the hardware schedule, provide a complete “Template List”. Further and upon request, provide copies to manufacturers or trades, whose work includes preparation of their products, to receive hardware. Provide copies of all such transmittals to the contractor, for their files. If physical samples are required, the manufacturer may request it from the general contractor and assume all responsibility of shipping it complete to the project.

E. Keying:

The hardware supplier shall meet with owner and/or architect to establish keying requirements. Provide a keying schedule, listing the levels of keying, (GMKD, MKD, Keyed alike, etc.) as well as an explanation of the key's function, the symbols used and the numbers of the doors controlled. This shall be provided in reference to the Door and Hardware Institute's manual "Keying Systems and Nomenclature". Also in conjunction the Door Index/Keying Schedule (which lists the door number, schedule heading, lock type and individual key symbol and remarks or special instructions) mentioned in paragraph "A", Schedules.

F. Operations and Maintenance Data:

At the completion of the project, provide an Owner's Operation and Maintenance Manual. The manual shall consist of a hard three ring binder. Include a copy of the latest revised and updated schedule of finish hardware, complete with catalog cuts and keying schedule. In addition, furnish one copy of maintenance and parts manual, for those items, for which they are readily available and normally provided.

Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.03 QUALITY ASSURANCE:

A. References:

Door hardware in this section shall meet the following standards as established by and the standard latest revision will be effect:

1. The Door and Hardware Institute (DHI) Various Publications
2. American National Standards (ANSI)/Builders Hardware Manufacturer Association (BMHA)
3. National Fire Prevention Association (NFPA)
 - a. NFPA 80 Standard for Fire Doors and Fire Windows
 - b. NFPA 101 Life Safety Code
 - c. NFPA 105 Smoke and Draft Control Door Assemblies
4. CABO/ANSI A117.1 Accessible and Usage Buildings and Facilities
5. Underwriters Laboratories (UL)
 - a. UL 10C – Fire Tests of Door Assemblies
 - b. UL 305 – Panic Hardware
6. Applicable State and Local Building Codes
7. American Disabilities Act (ADA) – 1990 Civil Law

B. Substitutions:

The manufacturers and catalog numbers listed are intended to establish a standard of quality. Items specified as "owner's standard" shall be provided as listed they have been requested by the Owner/Architect to match existing for continuity and/or future performance, maintenance standards or there is no equal product. Certain products have been selected for their unique characteristics and particular project suitability. Requests for substitutions will require architects approval and must be made in accordance with Division 01. Provide sample if requested. Substitution item will be reviewed and if approved it will be listed in an addendum prior to bid date.

C. Supplier Qualification:

The hardware supplier must be engaged currently in the furnishing, delivery and servicing of contract builders hardware. The firm shall have been furnishing hardware on similar projects in the vicinity for not less than five (5) years. The supplier must employ a certified Architectural Hardware Consultant (AHC) qualification and be available at reasonable times during the course of this project for consultation with the owner, architect and general contractor.

D. Single source responsibility: Obtain each type of hardware (latches and locks, hinges, exit devices, door closers, etc) from a single manufacturer.

F. Pre-installation Conference:

Conduct conference at project site to comply with requirements in Division 01 Section "Project Management and Coordination." Conference participants to include Owner, Contractor, Architect, and Door Hardware Suppliers Architectural Hardware Consultant. Conference to coordinate and review procedures' related to door hardware.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Marking and packaging:

All items of hardware shall be delivered to the job site, in the manufacturer's original packages, they shall be marked to correspond with approved hardware schedule, item number, heading number, door number and key sets symbols. Include installation instructions with each piece of hardware.

B. Delivery:

The hardware supplier shall coordinate delivery with general contractor, in order to compile a mutually beneficial delivery schedule, which imposes no hardship on either party. Some items of the hardware may be delivered to fabricators for factory installation in such case, the general contractor shall be advised of such shipments, along with copies of shipping tickets and any other documentation, thus transferring responsibility to the manufacturer or fabricator, for care of said hardware. Any delivery fees will be in the quoted price of the material.

C. Storage:

Hardware is to be delivered to the job site and stored in a clean dry, secure area, with adequate strong shelving. If requested by the contractor, the hardware supplier shall send a representative to the job site to "assist" the check in and laying-out of the hardware on the shelves. A representative of the contractor MUST be present. At this time any installation tips or special instructions will be reviewed.

D. No direct shipments will be allowed unless prior approval by the contractor.

1.05 WARRANTY:

A. Starting date for all warranty periods will be from the date of substantial completion.

B. All material must carry a limited warranty against defects in workmanship and materials from the date of acceptance of the project as follows.

1. Door Closers: at least ten (10) year warranty, except electronic closers, two (2) years
2. Locksets: at least seven (7) year warranty, except electrified devices, one (1) year.
3. Hinges: life of the building.
4. Balance of the hardware: one (1) year.

C. Products judged to be defective during the warranty period will be replaced or repaired in accordance with the manufacturers warranty at no additional cost to the owner. However, NO warranty against defects due to improper installation or failure to exercise normal maintenance.

- D. Provide Factory direct order numbers for all locksets, exit devices, and door closers with warranty information, prior to final payment.

1.06 MAINTENANCE:

A. Maintenance service:

If there are any products listed hereinafter that normally require a maintenance or service contract, provide the owner with details and costs of said contract.

B. Maintenance Tools and Instructions:

Furnish a complete set of specialized tools and maintenance instructions as needed for the owners continued adjustment, maintenance, and removal and the replacement of door hardware.

PART 2 – PRODUCTS

2.01 ENVIRONMENTALLY PREFERABLE PRODUCTS:

- A. Provide environmentally preferable products (EPP) to the greatest extent possible. Provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality and promote efficiencies in operational performance. EPP's include products that have low VOC content, high recycled content, and are manufactured, fabricated, or extracted within 500 miles of the construction site.
- B. Provide an aggregate recycled content of not less than 35% for all hardware devices.

2.02 MANUFACTURERS:

- A. The following manufacturers listed in 2.03 Materials have been selected for this project, whose products numbers have been used in the preparation for this specification.
- B. Note that even though an acceptable substitute manufacturer may be listed, the product must provide all the functions and features of the specified product or it will not be approved.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where the exact types of hardware specified are not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having as nearly as possible the same operation and quality as the type specified, subject to Architect's approval.

2.03 DOOR HARDWARE:

A. Screws and Fasteners:

Provide screws and fasteners of the proper size and type to properly anchor or attach the item of hardware they are intended for. Provide all fasteners with Phillips head, do not use through-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.

B. Hinges:

The following is a guide for hinge type required for this specification:

- 1) 1-3/4" thick doors up to and including 3'0" wide:
Exterior: standard (.134) or heavy weight (.180) ball bearing, bronze/stainless steel 4-1/2" high.

Interior: standard (.134) or heavy weight (.180) plain or ball bearing, steel 4-1/2" high.

- 2) 1-3/4" doors over 3'0" wide:
Exterior: standard (.134) or heavy weight (.180) ball bearing, bronze/stainless steel 5" high.
Interior: standard (.134) or heavy weight (.180) plain or ball bearing, steel 5" high.
- 3) Furnish one pair of hinges for all doors up to 60" high. Furnish one additional hinge for every additional 30" or fraction thereof. The width of hinges shall be sufficient to clear all trim.
- 4) Hinges specified Ives (IVE), approved acceptable substitute any BHMA member

C. Continuous Hinges:

Hinges shall be manufactured of three interlocking components, two hinge leaves and one cover channel. The door leaf and jamb leaf shall be geared together for the entire length of the hinge, and joined by a cover channel. The pinless assembly of three interlocking extrusions shall be applied to the full height of the door and frame without mortising. All aluminum components are to be anodized. All hinges shall carry Underwriters Laboratory certification, up to and including all 90 minute applications for wood doors, as well as 3 hour applications for all fire rated hollow metal doors.

- 1) Continuous Hinges specified Ives (IVE), approved acceptable substitute any BHMA member

D. Mortise Locks:

- 1) Locks shall be ANSI A156.13, Grade 1 Operational, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.05 KEYING.
- 2) Locks to have a standard 2-3/4" backset with a full 3/4" throw stainless steel mechanical anti-friction latch bolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
- 3) Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
- 4) Lever trim shall be cast or forged in the design specified, with 2-1/8" diameter roses with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle. Levers to be thru-bolted to assure proper alignment. Trim shall be applied by threaded bushing "no exposed screws".
- 5) Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
- 6) Locks meeting this specification: Best (BES) 45H x 15H approved acceptable substitute Corbin-Russwin ML2000, Sargent 8200. Schlage mortice locksets are not permitted, but Schlage Gr-1 cylindrical locksets are acceptable where cylindrical locksets are scheduled.

E. Door Closers:

- 1) All closers will utilize a stable fluid withstanding temperature range of 120 degrees f to -30 degrees f without seasonal adjustment of closer speed to properly close the door. Closers on fire rated doors will be provided with temperature stabilizing fluid that complies with standard UL 10C for "Positive Pressure Fire Tests of Door Assemblies" and UBC 7-2 (1997).
- 2) Door closers shall hydraulic, full rack and pinion action with a high strength cast iron cylinder. Cylinder body shall be 1 1/2" in diameter, and double heat-treated pinion shall be 11/16" in diameter. A written certificate showing successful completion of a minimum of 10,000,000 cycles for exterior door closers must be provided.
- 3) Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and back check.
- 4) All closer shall have forged steel main arms and forged forearms for parallel arm closers.
- 5) Closer cylinders and arms (and metal covers when specified) shall have a powder coating finish which has been certified to exceed 100 hours of salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification. For metal components that can't be powder coated, a special rust inhibiting finish (SRI) must be used.
- 6) All closers will not be seen on the public side or hallway side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate. Pay special attention to ST numbers, these are special template numbers requiring manufacturer to include special instructions, plates, brackets and/or screws.
- 7) Door closers meeting this specification: LCN (LCN) 4040XP. Approved acceptable substitutions include Sargent and Norton.

F. Door Stops and Holders:

It shall be the responsibility of the hardware supplier to provide doorstops for all doors in accordance with following requirements:

- 1) Wall stops may be used on CMU walls only.
- 2) Provide dome type floor stops of the proper height.
- 3) At any opening where a wall or floor stop cannot be used, a heavy-duty overhead stop will be required.
- 4) At no time will a hinge pin stop be acceptable.
- 5) Stops specified Ives (IVE), approved acceptable substitute any BHMA member

G. Overhead Stops/holders:

Overhead door stops and holders; surface or concealed at the top of the door shall have shock absorber in extruded stainless steel case. Hold open and shock absorber feature that automatically engages and releases the door. Sliding member in the channel shall have accessible adjustment screw to regulate hold open tension.

Overhead stops/holders specified Glynn-Johnson (GLY), approved acceptable substitute any BHMA member

H. Thresholds and Gasketing:

Furnish as specified and per details. Match finish of other items as closely as possible. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available. Threshold, sweep and weather-stripping will be supplied to weather proof the exterior doors. The thresholds will be supplied to fit the particular sill conditions and not conflict with the American Disabilities Act (ADA). Exterior pairs of doors will have split astragal to prevent air infiltration. Interior doors may require gasketing, thresholds and sweeps to act as a sound barrier per the owner's request. Set all thresholds in continuous mastic water barrier.

- 1) Thresholds specified National Guard Products (NGP), approved acceptable substitute Reese, Zero.

I. Silencers:

Furnish Ives SR64 for the "push in type: for metal frames, Ives SR65 for wood frames, or Ives SR66 adhesive type. Supply 3 each for single doors, 2 each for pair of doors. Omit silencers where gasketing is scheduled.

- 1) Silencers specified Ives (IVE), approved acceptable substitute any BHMA member

2.04 DOOR HARDWARE FINISHES:

- A. All hardware is to be furnished in one of the following finishes, depending upon the item and it's base metal. All satin chrome or satin stainless steel or as noted.

<u>Item</u>	<u>BHMA #</u>	<u>US #</u>
Hinges interior	652	(US26D)
Continuous Hinges	628	(US28)
Locks	630	(US32D)
Door Closers	689	(alum painted)
Door wall stops	630	(US32D)
Overhead Holders	630	(US32D)

Other items to be 630 if available. If not, 626 over brass or bronze.

2.05 DOOR HARDWARE KEYING:

- A. Meet with Architect and Owner to finalize keying requirements and obtain keying instructions in writing as outlined in Division 1. System to be keyed in the existing Grand Master Key System as selected by the Owner.
- B. Cylinders shall be Interchangeable Cores.
- C. Provide temporary construction keying system, furnished along with three (3) Construction Control Keys and twelve (12) each Construction Change Keys
- D. Furnish permanent directly to Owner's representative by secure courier, return receipt requested, from manufacturer. Failure to properly comply with these requirements shall be cause for replacement of cylinders and keys involved at no additional cost to Owner.
- E. Mark permanent cylinders and keys with applicable blind code for identification. Visual key control mark cores with side stamping. These visual key control marks or codes shall not include actual key cuts.
- F. Cylinder and key identification stamping to be approved by Architect and Owner. Failure to properly comply with these requirements shall be cause for replacement of cylinders and keys involved at no additional cost to Owner.

- G. Provide cylinders with nickel silver bottom pins.
- H. Stamp keys with Owner unique key system facility code as established by the manufacturer, key symbol (VKC) and embossed with "DO NOT DUPLICATE" along with the full patent number to enforce the patent protection.
- I. Furnish keys in following quantities:
 - 1) Furnish a sum total of three (3) change keys per cylinder. This sum total of keys shall be cut and furnished as directed by OWNER. Any unused balance of cut change keys shall be furnished as key blanks directly to Owner with the Cut Keys.
 - 2) Furnish a sum total of three (3) Permanent Control Keys and a sum total of six (6) each Master Keys of each type as directed by Owner. Any unused balance of Master Keys of any type shall be furnished as key blanks directly to Owner with the Cut Keys.
- J. Cylinders and Keying specified Stanley Best (BES), The system shall be 7-pin Peaks.

PART 3 – EXECUTION

3.01 EXAMINATION:

Prior to installation of hardware, examine condition of opening size, shall be verified as to door frames being plumb and of correct tolerance, walls or any related items that would prevent proper installation of doors and hardware. Correct any and all defects prior to proceeding with installation.

3.02 INSTALLATION:

- A. Prior to hardware installation the general contractor will set up a preinstall job site meeting with the hardware supplier, hardware installer and any other trades people deemed necessary (i.e. electrical contractor, security contractor, etc.) for communication to assure trouble free installation. This meeting would be best coordinated with the delivery requirements detained in section 1.04.
- B. Review with the architect the mounting locations of various items of hardware in accordance with the Door and Hardware Institute's (DHI), "Recommended Locations for Architectural Hardware" for standard and custom steel doors and frames, and DHI's WDHS-3 for flush wood doors. Special attention to be given to all special and unusual conditions. All hardware shall be installed by carpenter mechanics skilled in the application of said hardware.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- D. Set thresholds for exterior doors in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 "Joint-Sealers".

3.03 FIELD QUALITY CONTROL:

After all hardware has been installed, provide the services of a qualified hardware consultant to check for proper installation of hardware, according to the "Approved" hardware and keying schedule's. Also, check the operation and adjustment of all hardware items in accordance with the manufacturer's recommendations.

3.04 ADJUSTING AND CLEANING:

At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to all door closers and other items of hardware. Where hardware is found defective, repair or replace or otherwise correct as directed. After building is occupied, arrange an appointment with owner's representative to instruct in the proper use, servicing, adjusting and maintenance of the hardware. Hardware items specified to receive antimicrobial coating may be cleaned with a mild detergent, air-dry or dried with soft cloth.
 Avoid harsh abrasive cleaners and abrasive cleaning pads.

3.05 PROTECTION:

Provide protection for all items of hardware during construction, to prevent damage, field painting or marring. Damaged or disfigured hardware shall be replaced or corrected by the responsible party.

3.06 HARDWARE SCHEDULE:

- A. Provide hardware for each door to comply with requirements of this section "Finish Hardware" hardware set numbers indicated in the door schedule, and in the following schedule of hardware sets.
- B. It is intended that the following schedule includes all items of the finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, it shall be the responsibly of the hardware supplier to supply the proper materials.
- C. Hardware Sets:

Hardware Group No. 1

For use on mark/door #(s): 1

Provide each SGL door(s) with the following:

<u>Qty</u>	<u>Unit</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	DORMITORY LOCK	45H-7-TA-15H	630	BES
1	EA	SURFACE CLOSER	4040XP SCUSH ST1586	689	LCN
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	700SA	CL	NGP
1	EA	DOOR SWEEP	C627A	CL	NGP
1	EA	THRESHOLD	425 MS/LA	AL	NGP

Hardware Group No. 2

For use on mark/door #(s): 1A; 1B; 6; and Access Doors.

Provide each RU door(s) with the following:

<u>Qty</u>	<u>Unit</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1	EA	CYLINDER	AS REQUIRED	626	BES
BALANCE OF HARDWARE BY DOOR MANUFACTURER					

Hardware Group No. 3

DOOR HARDWARE

For use on mark/door #(s): 2; 3.

Provide each SGL door(s) with the following:

<u>Qty</u>	<u>Unit</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	DORMITORY LOCK	45H-7-T-15H-VIN	630	BES
1	EA	SURFACE CLOSER	4040XP SCUSH ST1586	689	LCN
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	700SA	CL	NGP
1	EA	DOOR SWEEP	C627A	CL	NGP
1	EA	THRESHOLD	425 MS/LA	AL	NGP

Hardware Group No. 4

For use on mark/door #(s): 4; 5.

Provide each SGL door(s) with the following:

<u>Qty</u>	<u>Unit</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	CLASSROOM LOCK	45H-7-R-15H	630	BES
1	EA	OH STOP & HOLDER	79H	626	GLY
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	700SA	CL	NGP
1	EA	DOOR SWEEP	C627A	CL	NGP
1	EA	THRESHOLD	425HD MS/LA	AL	NGP

END OF SECTION 087100 DOOR HARDWARE

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board for ceilings.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
 - 2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Gypsum.
 2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company.
 6. PABCO Gypsum.
 7. Temple-Inland.
 8. USG Corporation.
- B. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: As indicated 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM-C-1002, unless otherwise indicated.
- D. Acoustical Perimeter Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
- E.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Ceiling Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions at perimeter ceilings.
- K. Install thermal blankets after installing gypsum panels.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Moisture- and Mold-Resistant Type: Ceilings.
- B. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners[unless otherwise indicated].

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 4: Primer and its application to ceiling surfaces is specified in Section 099123 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Wood beams.
 - 4. Hollow metal doors.
 - 5. Exterior soffit siding.
 - 6. Miscellaneous sitework items.
 - 7. Miscellaneous items as indicated and required by Architect.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for painting of metal.
 - 2. Section 061000 "Rough Carpentry" for painting of wood beams.
 - 3. Section 074600 "Siding" for painting of soffit panels.
 - 4. Section 081113 "Hollow Metal Doors and Frames" for painting of doors and frames.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Sherwin-Williams Company (The).
 - 5. Porter Paints.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
- 2.3 METAL PRIMERS
- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
 - B. Primer, Galvanized, Water Based: MPI #134.
 - C. Primer, Galvanized: As recommended in writing by topcoat manufacturer.
 - D. Primer, Quick Dry, for Aluminum: MPI #95.
- 2.4 WOOD PRIMERS
- A. Primer, Latex for Exterior Wood: MPI #6.
- 2.5 WATER-BASED PAINTS
- A. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
 - B. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (Gloss Level 5): MPI #163.
- 2.6 SOURCE QUALITY CONTROL
- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Wood beams: 15 percent.
 2. Soffit panels: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 1. SSPC-SP 3, "Power Tool Cleaning."
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- F. Aluminum Substrates: Remove loose surface oxidation.
- G. Wood Substrates:
 1. Sand surfaces that will be exposed to view, and dust off.
 2. Prime edges, ends, faces, undersides, and backsides of wood.
 3. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint where exposed to view.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.
- B. Galvanized-Metal Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
- C. Wood Substrates: Parallel-strand lumber beam.
 - 1. Latex System:
 - a. Prime Coat: Primer, latex for exterior wood, MPI #6.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
- D. Fiber Cement Soffit Board:
 - 1. Latex System:
 - a. Prime Coat: Latex, exterior, matching topcoat.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. Wood.
 - 3. Gypsum board.
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 2. Section 092900 "Gypsum Board" for painting of gypsum ceilings.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Sherwin-Williams Company (The).
 - 5. Porter Paints.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Dry-Fog Coatings: 400 g/L.
 4. Primers, Sealers, and Undercoaters: 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coatings: 100 g/L.
 9. Shellacs, Clear: 730 g/L.
 10. Shellacs, Pigmented: 550 g/L.
- D. Colors: As selected by Architect from manufacturer's full range.
- 2.3 BLOCK FILLERS
- A. Block Filler, Latex, Interior/Exterior: MPI #4.
- 2.4 PRIMERS/SEALERS
- A. Primer Sealer, Latex, Interior: MPI #50.
- B. Primer, Latex, for Interior Wood: MPI #39.
- 2.5 WATER-BASED PAINTS
- A. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.
- 2.6 SOURCE QUALITY CONTROL
- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (CMU): 12 percent.
 2. Wood: 15 percent.
 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- E. Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint where exposed in equipment rooms (including plywood that equipment is mounted to).

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.
- B. Wood Substrates: Including wood blocking.
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.
- C. Gypsum Board Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Prime Coat: Latex, interior, matching topcoat.
 - c. Intermediate Coat: Latex, interior, matching topcoat.
 - d. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

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. Exterior weather-resistant tackboards.

1.3 DEFINITIONS

- A. Tackboard: Framed or unframed, tackable, visual display board assembly.
- B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes tackboards.
- C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
- B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include sections of typical trim members.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

- B. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- C. Adhesives: Manufacturer's standard product that complies 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."

2.2 TACKBOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis of Design: Mooreco; outdoor enclosed bulletin board cabinet.
 - 1. Best-Rite Manufacturing.
 - 2. Claridge Products and Equipment, Inc.
 - 3. Ghent Manufacturing, Inc.
 - 4. Marsh Industries, Inc.; Visual Products Group.
- C. Plastic-Impregnated-Cork Tackboard: 1/4-inch- (6-mm-) thick, plastic-impregnated cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard backing.

2.3 TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; 36"H x 36"W.
 - 1. Factory-Applied Trim: Manufacturer's standard.

2.4 FABRICATION

- A. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
 - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.7 VISUAL DISPLAY SURFACE SCHEDULE

- A. Tackboard: Factory assembled.
 - 1. Tack Surface: Plastic-impregnated-cork tackboard assembly.
 - a. Color: As selected by Architect from full range of industry colors.
 - 2. Corners: Square.
 - 3. Width: 36".
 - 4. Height: 36".
 - 5. Mounting: Wall.

6. Mounting Height: As indicated on Drawings.
7. Edges: Concealed by trim.
 - a. Factory-Applied Aluminum Trim: Manufacturer's standard style, with clear anodic finish.
 - 1) Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

3.6 WARRANTY

- A. Special Warranty for Exterior Unit:
 1. Warranty Period: Five years after date of Substantial Completion.

END OF SECTION 101100

SECTION 101423 - PANEL SIGNAGE

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. Exterior use room-identification signs for restrooms.

1.3 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, tpestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Sign Systems, Inc.
 - 2. Advance Corporation; Braille-Tac Division.
 - 3. Allen Industries, Inc.
 - 4. Allen Markings International.
 - 5. APCO Graphics, Inc.
 - 6. ASE, Inc.
 - 7. ASI Sign Systems, Inc.
 - 8. Best Sign Systems Inc.
 - 9. Bunting Graphics, Inc.
 - 10. Clarke Systems.
 - 11. Diskey Sign Company.
 - 12. Fossil Industries, Inc.
 - 13. InPro Corporation.
 - 14. Mohawk Sign Systems.
 - 15. Nelson-Harkins Industries.
 - 16. Poblocki Sign Company, LLC.
 - 17. Seton Identification Products.
 - 18. Supersine Company (The); Division of Stamp-Rite, Inc.
 - 19. Vista System.
 - 20. Vomar Products, Inc.
- B. Room Identification Sign: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
 - 1. Acrylic Sheet: 0.120 inch (3.04 mm) thick clear acrylic sheet with opaque color coating, subsurface applied.
 - a. Colored Coatings for Acrylic Sheet: For background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
 - 1) Custom Color: Match Architect's sample using Pantone color matching system.
 - 2. Edge Condition: Square cut.
 - 3. Corner Condition: Square.
 - 4. Mounting: Unframed.
 - a. Surface wall mounted with concealed anchors.
 - 5. Tactile and Braille Characters: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

- a. Panel Material: White acrylic sheet.
 - b. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).
6. Graphic Content and Style: Provide sign copy that complies with requirements indicated on Drawings for size, style, spacing, and content.
 7. Location: Men's and Women's Restroom doors.
 8. Text and Typeface: Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Concealed Fasteners and Anchors: Manufacturer's standard for concrete masonry units on exterior surfaces.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Install per ADA and ANSI requirements.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Public-use bathroom accessories.
 - 2. Warm-air dryers.
 - 3. Childcare accessories.
 - 4. Mirror units.
 - 5. Book shelf unit.
- B. Owner-Furnished and Owner-Installed Material:
 - 1. Roll paper towel dispensers (18"W x 24"H).
 - 2. Trash receptacle.
 - 3. Soap dispenser.
 - 4. Sanitary napkin dispenser.
 - 5. Toilet tissue dispenser.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions; ADA mounting heights.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

- 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.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE BATHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
- B. Grab Bar:
 - 1. Basis-of-Design Product: Bobrick – B6806.99-36, B6806.99-42 and B6806.99-18.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 4. Outside Diameter: 1-1/2 inches (38 mm).
 - 5. Configuration and Length: As indicated on Drawings.
- C. Mirror Unit:

1. Basis-of-Design Product: Bobrick B290-1836.
2. Frame: Stainless-steel channel.
 - a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts or wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: 18 inches by 36 inches.

2.3 WARM-AIR DRYERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. American Specialties, Inc., Turbo-Dry (Model # 0197)
 2. Dyson Airblade (Model # AB02)
- C. Warm-Air Dryer :
 1. Basis-of-Design Product: Excel Dryer, Inc.; Xlerator, Model #XL
 2. Mounting: Surface mounted.
 3. Operation: Electronic-sensor activated with timed power cut-off switch.
 - a. Operation Time: 30 to 40 seconds.
 4. Cover Material and Finish: Steel, with white enamel finish.
 5. Electrical Requirements: As required by manufacturer.

2.4 FOLD-DOWN PURSE SHELF

- A. Basis-of-Design Product: Bobrick Stainless Steel.
- B. Mounting: Surface.
- C. Description: Hinged unit with spring loaded shelf that automatically returns to vertical position.

2.5 CHILDCARE ACCESSORIES

- A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two paragraphs and list of manufacturers below. See Section 016000 "Product Requirements."
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. American Specialties, Inc.
 2. Brocar Products, Inc.
 3. Diaper Deck & Company, Inc.
 4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 5. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.
 6. SSC, Inc.
 7. Tubular Specialties Manufacturing, Inc.
- D. Diaper-Changing Station:
 1. Basis-of-Design Product: Bobrick – B2210.
 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

- a. Engineered to support a minimum of 250-lb (113-kg) static load when opened.
 3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
 4. Operation: By pneumatic shock-absorbing mechanism.
 5. Material and Finish: HDPE in manufacturer's standard color.
 6. Liner Dispenser: Built in.
- 2.6 UNDERLAVATORY GUARDS
- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 1. Plumberex Speciality Products, Inc.
 2. Turebro by IPS Corporation.
- 2.7 FABRICATION
- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
 - B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories at ADA mounting heights, and according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire End & Croker Corporation.

- b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsens Manufacturing Company.
 - e. Moon American.
 - f. Potter Roemer LLC.
2. Valves: Manufacturer's standard.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- 2.3 MOUNTING BRACKETS
- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated.
 - c. Badger Fire Protection.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - g. Larsens Manufacturing Company.
 - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

DIVISION 20 - MECHANICAL

SECTION 200100 - GENERAL PROVISIONS - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Advertisement for Bids, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- 1.2 Each Proposer shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.
- 1.3 The work included in this division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s) indicated or specified in the Contract Documents.
- 1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.
- 1.5 It is not the intent of this section of the specifications to make any Contractor, other than the General Contractor, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this section of the specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.
- 1.6 It is the intent of this Contract to deliver to the Owner a new project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.
- 1.7 In general, and to the extent possible, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least forty-eight (48) hours prior to the interruption of any services (gas, domestic water, heating, etc.). The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.
- 1.8 Definitions and Abbreviations:
 - 1.8.1 Contractor - Any Contractor whether proposing or working independently or under the supervision of a Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Sprinkler, Gas Systems, etc.).
 - 1.8.2 Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc. In this case: CMTA, Inc., Consulting Engineers.

- 1.8.3 Architect - The Architect of Record for the project.
- 1.8.4 Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
- 1.8.5 Provide - Furnish and install complete, tested and ready for operation.
- 1.8.6 Install - Receive and place in satisfactory operation.
- 1.8.7 Indicated - Listed in the Specifications, shown on the Drawings or Addenda thereto.
- 1.8.8 Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- 1.8.9 Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owners, etc.
- 1.8.10 Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- 1.8.11 OSHA - Office of Safety and Health Administration.
- 1.8.12 KBC - Kentucky Building Code.
- 1.8.13 The Project - All of the work required under this Contract.
- 1.8.14 NEC - National Electrical Code.
- 1.8.15 NFPA - National Fire Protection Association.
- 1.8.16 ASME - American Society of Mechanical Engineers.
- 1.8.17 SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
- 1.8.18 ANSI - American National Standards Institute.
- 1.8.19 ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
- 1.8.20 NEMA - National Electrical Manufacturers Association.
- 1.8.21 UL - Underwriters Laboratories.
- 1.8.22 ADA - Americans with Disabilities Act.
- 1.9 Required Notices: Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 2 – INTENT:

- 2.1 It is the intention of the Contract Documents to call for finished work, tested and ready for operation.
- 2.2 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

PART 3 – DRAWINGS AND SPECIFICATIONS:

- 3.1 The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.
- 3.2 The drawings and specifications are intended to supplement each other. No Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Proposer shall request a clarification not less than twelve days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.
- 3.3 The drawings and specifications shall be considered to be cooperative and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- 3.4 Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- 3.5 The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- 3.6 Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- 3.7 Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.
- 3.8 Each Proposer shall review all drawings including Architectural, Mechanical, Electrical, Fire Protection, Landscaping, Structural, Surveys, etc., to insure that the work he intends to provide does not encroach a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Proposer's responsibility to satisfactorily eliminate any such encroachment conflict or effect prior to the submission of his proposal. Each Proposer shall in particular insure that there is adequate space to install his equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.
- 3.9 Where on the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation

or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

- 3.10 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- 3.11 Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.
- 3.12 Special Note: Always check ceiling heights indicated on Architectural Drawings and Schedules and insure that they may be maintained after all mechanical and electrical equipment is installed. Do not install equipment in the affected area until the conflict is resolved.

PART 4 - EXAMINATION OF SITE AND CONDITIONS:

- 4.1 Each Proposer shall inform their self of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. Each Proposer shall also fully acquaint their self with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. His proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

PART 5 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

- 5.1 When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall renumerate them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.
- 5.2 Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of Paragraph (5.1) immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of ten days prior to bids.
- 5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineers.
- 5.4 Each Proposer shall furnish along with his proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not insure that the Engineers will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.
- 5.5 Required Notices: Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws,

ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 6 - SUPERVISION OF WORK:

- 6.1 The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 7 - CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

- 7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. He shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to his part of the work prior to submission of a proposal.
- 7.2 The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
- 7.3 All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
- 7.4 All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.
- 7.5 All plumbing work is to be constructed and installed in accordance with applicable codes, plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such plans are in the possession of the Plumbing Contractor.
- 7.6 All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Kentucky Building Code (KBC) and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.
- 7.7 The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
- 7.8 Where minimum code requirements are exceeded in the Design, the Design shall govern.
- 7.9 The Contractor shall insure that his work is accomplished in accord with the OSHA Standards and that he conducts his work and the work of his personnel in accord with same.
- 7.10 All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings and Construction, State of Kentucky and the American Disabilities Act.

- 7.11 All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local water utility company.
- 7.12 All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing such installations.
- 7.13 Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the State Division.

PART 8 - EQUIPMENT SUPPORT:

- 8.1 Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

PART 9 - DUCT AND PIPE MOUNTING HEIGHTS:

- 9.1 All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

PART 10 - COST BREAKDOWNS (SCHEDULE OF VALUES):

- 10.1 Within thirty days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

PART 11 - GUARANTEES AND WARRANTIES:

- 11.1 The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into their Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of his operator or other employees. Refer to other sections for any special or extra warranty requirements.

- 11.2 Provide all warranty certificates to Owner.

PART 12 - CHANGES IN MECHANICAL WORK:

- 12.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 13 - CLAIMS FOR EXTRA COST:

13.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 - SURVEY, MEASUREMENTS AND GRADE:

14.1 The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations and measurements. The Contractor must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from failure to do so.

14.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

14.3 Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 15 - TEMPORARY USE OF EQUIPMENT:

15.1 The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineers. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

15.2 Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 16 - TEMPORARY SERVICES:

16.1 The Contractor shall arrange any temporary water, electrical and other services which he may require to accomplish his work. Refer also to General and Special Conditions.

PART 17 - RECORD DRAWINGS:

17.1 The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineers upon completion of the work.

17.2 All underground utilities/piping installed as part of this project shall be surveyed by a land surveyor licensed in the State of Kentucky. The survey shall be furnished on a compact disc in AutoCad “.dwg” format and “.pdf” format. Also furnish one mylar copy.

PART 18 - MATERIALS AND WORKMANSHIP:

18.1 All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Proposer shall determine that the materials and/or equipment he proposes to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be

- necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.
- 18.2 Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.
- 18.3 Use extreme care in the selection of equipment and its installation to insure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.
- 18.4 Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.
- 18.5 All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity. Pumps shall have a data plate indicating horsepower, static pressure head and flow rate.

PART 19 - COOPERATION AND COORDINATION WITH OTHER TRADES:

- 19.1 The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
- 19.2 Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than $\frac{1}{4}'' = 1'-0''$, clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.
- 19.3 The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 20 - QUALIFICATIONS OF CONTRACTOR/WORKMEN:

- 20.1 All mechanical contractors bidding this project must have been a licensed company for a minimum of two years to qualify to bid this project. Individual employee experience does not supersede this requirement.
- 20.2 All mechanical subcontractors bidding the mechanical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- 20.3 All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workman shall refrain from work in areas not deemed satisfactory. Requests for relief of a workman shall be made through the normal channels of Architect, Contractor, etc.
- 20.4 All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined and clarified under Kentucky State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.

- 20.5 The installation of all Heating, Ventilating and Air-Conditioning Systems (HVAC) by any Contractor, whether in existing or new building construction shall be performed by a Licensed Kentucky Master HVAC Contractor. This includes any Contractor installing HVAC systems, piping and ductwork.
- 20.6 All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades, except where only small amounts of such work are required and are within the competency of workmen directly employed by the Contractor involved.
- 20.7 All automatic control systems shall be installed by workmen normally engaged or employed in this type work, except in the case of minor control requirements (residential type furnaces, packaged HVAC equipment with integral controls, etc.) in which case, if a competent workman is the employee of this Contractor, he may be utilized subject to review of his qualifications by the Engineer and after written approval from same.
- 20.8 All special systems (Automatic Sprinkler Equipment, etc.) shall be installed only by workmen normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.
- 20.9 All electrical work shall be installed pursuant to current State law. (ie. All electrical work shall be installed by licensed electricians).

PART 21 - CONDUCT OF WORKMEN:

- 21.1 The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

PART 22 - PROTECTION OF EQUIPMENT:

- 22.1 The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense.

PART 23 - SCAFFOLDING, RIGGING AND HOISTING:

- 23.1 The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

PART 24 - BROKEN LINES AND PROTECTION AGAINST FREEZING:

- 24.1 No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Special Note: Insulation on piping does not necessarily insure that freezing will not occur.

PART 25 – CLEANING:

- 25.1 The Contractor shall, at all times, keep the area of their work presentable to the public and clean of rubbish and debris caused by his operations; and at the completion of the work, shall remove all rubbish, debris, all of his tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- 25.2 After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.
- 25.3 Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not “dried-in”. If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

PART 26 - CONCRETE WORK:

- 26.1 The Contractor shall be finally responsible for the provisions of all concrete work required for the installation of any of his systems or equipment. The Contractor may, at his option, arrange with the others to provide the work. This option, however, will not relieve the Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Mechanical work shall be 3500 psi minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven (7) days after pour. Insert 6-inch steel dowel rods into floors to anchor pads.
- 26.2 All concrete pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc. as required. Pads larger than 18" in width shall be reinforced with ½" round bars on 6" centers both ways. Bars shall be approximately 3" above the bottom of the pad. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms, all surfaces shall be rubbed to a smooth surface. Chamfer all square edges one-half inch.
- 26.3 In general, concrete pads for equipment shall extend four (4) inches beyond the equipment's base dimensions. Where necessary, extend pads 30 inches beyond base or overall dimensions to allow walking and servicing space.
- 26.4 Exterior concrete pads shall be four (4) inches minimum above grade and four (4) inches below grade on a tamped four (4) inch dense grade rock base unless otherwise indicated or specified. Surfaces of all foundations and bases shall have a smooth finish with one-half (½) inch chamfer on exposed edges. Turn down edges 18” below grade.

PART 27 - NOISE, VIBRATION OR OSCILLATION:

- 27.1 All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound

or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.

- 27.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.
- 27.3 The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineers.

PART 28 – ACCESSIBILITY:

- 28.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
- 28.2 The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.
- 28.3 The Contractor shall provide in the bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

PART 29 - RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, SURFACES, ETC.:

- 29.1 The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and/or Engineer.

PART 30 - MAINTENANCE OF EXISTING UTILITIES AND LINES:

- 30.1 The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily.
- 30.2 Utilities and lines, where known, are indicated on the drawings. Locations and sizes are approximate. Prior to any excavation being performed, the Contractor shall ascertain that no utilities or lines are endangered by new excavation. Exercise extreme caution in all excavation work.
- 30.3 If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation or blasting in the respective area.
- 30.4 Cutting into existing utilities and services where required shall be done in coordination with and only at times designated by the Owner of the utility.

- 30.5 The Contractor shall repair to the satisfaction of the Owner and Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
- 30.6 Machine excavation shall not be permitted within ten feet of electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only.
- 30.7 Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

PART 31 – WEATHERPROOFING:

- 31.1 Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

PART 32 - FINAL CONNECTIONS TO EQUIPMENT:

- 32.1 The Contractor shall finally connect to mechanical services (water, gas, air), any terminal equipment, appliances, etc., provided under this and other divisions of the work. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineers prior to installation.

PART 33 - REQUIRED CLEARANCE FOR ELECTRICAL EQUIPMENT:

- 33.1 The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

PART 34 – INDEMNIFICATION:

- 34.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 35 - HAZARDOUS MATERIALS:

- 35.1 Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- 35.2 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

- 35.3 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.
- 35.4 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.
- 35.5 No asbestos or mercury containing materials shall be installed in this project.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 200200 - SCOPE OF THE MECHANICAL WORK

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following:
- 1.3 Complete domestic water service to 5'-0" beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.
- 1.4 Complete sanitary sewer service to 5'-0" beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.
- 1.5 Interior domestic hot, cold and recirculating hot water system.
- 1.6 Interior soil, waste and vent systems.
- 1.7 All plumbing equipment, fixtures and fittings.
- 1.8 All mechanical exhaust systems.
- 1.9 All insulation associated with mechanical systems.
- 1.10 Complete heating and ventilation systems.
- 1.11 All required pressure testing, flushing, purging, pressure and flow testing requirements.
- 1.12 Final coordination and connection of all mechanical equipment furnished by others (e.g., kitchen equipment).
- 1.13 All required controls, including self checkout and commissioning.
- 1.14 All applicable services and work specified in GENERAL PROVISIONS - MECHANICAL.
- 1.15 Provide all required motor starters, etc. not provided under the electrical sections.
- 1.16 Thorough instruction of the owner's maintenance personnel in the operation and maintenance of all mechanical equipment.
- 1.17 Thorough coordination of the installation of all piping, equipment and any other material with other trades to insure that no conflict in installation.
- 1.18 Approved supervision of the mechanical work.
- 1.19 Procurement of all required inspections, including fees for all inspection services and submission of final certificates of inspection to the Engineers (Plumbing, etc.).

- 1.20 Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.
- 1.21 Equipment and controls start-up, verification and documentation as specified.
- 1.22 Record drawings, final inspection certificates, test results, O & M documentation, warranty certification, spare parts and other specified closeout documentation.
- 1.23 Required schedule of values breakdown.
- 1.24 Pipe, duct and equipment identifications.
- 1.25 Pre-installation meetings and equipment mockups.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 200300 - REQUIRED SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE
MANUALS, PARTS LISTS, SPECIAL KEYS & TOOLS

PART 1 - GENERAL:

- 1.1 The Contractor's attention is directed also to Section 013305-Submittal Procedures for submittal process and requirements.
- 1.2 Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.
- 1.3 Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.
- 1.4 All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.
- 1.5 It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- 1.6 The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.
- 1.7 Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.
- 1.8 If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.
- 1.9 Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

1.10 Shop Drawing Submittals

- 1.10.1 All submittals for HVAC equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.
- 1.10.2 All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule.
- 1.10.3 All items submitted shall be designated with the same identifying tag as specified on each sheet.
- 1.10.4 Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

PART 2 - SHOP DRAWINGS:

- 2.1 Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

- (2.2.1) Plumbing Fixtures, Fittings and Trim
- (2.2.1) Plumbing Equipment
- Floor Drains
- (2.2.1) Electric Heaters
- (2.2.2&2.2.1) Controls
- Louvers
- Ductwork Accessories (Dampers, Sealant, etc.)
- Insulation
- (2.2.1) Exhaust Fans

2.2 Special Notes:

- 2.2.1 Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (1) above. These documents shall include at least:
 - 2.2.1.1 Detailed operating instructions
 - 2.2.1.2 Detailed maintenance instructions including preventive maintenance schedules.
 - 2.2.1.3 Addresses and phone numbers indicating where parts may be purchased.
 - 2.2.1.4 Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.
- 2.2.2 Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system.

PART 3 - SPECIAL WRENCHES, TOOLS, ETC.:

- 3.1 The Contractor shall furnish, along with equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed under the Contract. Wrenches shall include necessary keys, handles and operators for valves, cocks, hydrants, etc. A reasonable number of each shall be furnished. Provide the following minimally:
 - 3.1.1 Two (2) wall hydrant keys per hose bibb (HB or freezeproof wall hydrant (FPWH)).

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 201100 - SLEEVING, CUTTING, PATCHING, FIRESTOPPING AND REPAIRING

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall be responsible for all openings, sleeves, trenches, etc., that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the Construction Manager and all other trades. Coordinate with the General Contractor, any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.
- 1.3 The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.
- 1.4 The Contractor shall notify other trades in due time where he will require openings or chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- 1.5 The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Engineer.
- 1.6 All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Construction Manager at the direction of the Contractor whose work is affected. The cost of this work shall be paid for by the Contractor responsible.

PART 2 – SLEEVES:

- 2.1 Cast iron or Schedule 40 (minimum) steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing.
- 2.2 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation.
- 2.3 Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Vertical sleeves in roofs shall be flashed and counterflashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed.
- 2.4 Where sleeves pass through roof construction, sleeves shall extend minimum of 8" above the roof. Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated.
- 2.5 Openings thru structural slabs shall be accomplished by means of sleeves. (No drilling will be allowed in structural slabs). In waffle, pre-cast or pan joist construction, openings may be made by means of diamond

(core) drilling or as otherwise approved by the Engineers.

PART 3 – CUTTING:

- 3.1 All rectangular or special shaped openings in plaster, stucco or similar materials, including gypsum board, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, lighting fixtures, etc.
- 3.2 The Mechanical Contractor shall coordinate all openings in masonry walls with the Construction Manager; and, unless otherwise indicated on the Architectural drawings, shall provide lintels for all openings required for the mechanical work (Louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:
 - 3.2.1 New Openings under 48" in width: Provide one 3½"x3½"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.
 - 3.2.2 New Openings over 48" in width: Consult the Project Structural Engineer.
- 3.3 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.
- 3.4 Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

PART 4 - PATCHING AND REPAIRING:

- 4.1 Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.
- 4.2 Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced to the satisfaction of the Engineer.
- 4.3 Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
- 4.4 Where the installation of ductwork requires the penetration of non-rated floors, the space around the duct or pipe shall be tightly filled with an approved non-combustible material.
- 4.5 Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door.
- 4.6 Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.
- 4.7 Stainless steel collars shall be provided around all ducts, flues, breechings, large pipes, etc. at all wall penetrations; both sides.

PART 5 - FIRESTOPPING MATERIALS:

- 5.1 All mechanical pipes and ducts penetrating fire rated floors and walls must be firestopped. Firestopping

assembly must be UL listed.

- 5.2 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type. (i.e., one hour fire rated gypsum wall board with insulated metal pipe penetration.)
- 5.3 3M fire protection products are listed below. Approved manufacturers: 3M, Meta Caulk Hilti, STI. Equivalent products may be submitted if they are UL listed.
- 5.4 The manufacturer of the firestopping materials must provide on site training for the Contractor. The training session shall demonstrate to the contractors the proper installation techniques for all the firestopping materials. The training session shall be four hours minimum. Contact the Engineer prior to conducting this training session.
- 5.5 Firestopping materials to include but not limited to the following:
 - 5.5.1 3M fire barrier FS-195 wrap/strip.
 - 5.5.2 3M fire barrier CP 25 caulk.
 - 5.5.3 3M fire barrier MP moldable putty.
 - 5.5.4 3M fire barrier RC-1 restricting collar with steel hose clamp.
 - 5.5.5 3M fire barrier damming materials.
 - 5.5.6 3M fire barrier CS-195 composite sheet.
 - 5.5.7 3M fire barrier fire dam 150 caulk.
 - 5.5.8 Steel sleeves.

PART 6 - INSTALLATION REQUIREMENTS OF FIRESTOPPING MATERIALS:

- 6.1 The following indicates the 3M penetration detail for uninsulated pipe penetration of various wall and floor construction types:
 - 6.1.1 One, two or three hour fire rated solid or block concrete wall - 3M #5300-MPC16 or 3M #5300-MPC26.
 - 6.1.2 One hour fire rated gypsum wallboard - 3M #5300-MPC7.
 - 6.1.3 Two hour fire rated gypsum wallboard - 3M #5300-MPC7.
- 6.2 The following indicates the 3M penetration detail for -insulated pipe penetrations of various wall and floor construction types:
 - 6.2.1 One, two and three hour concrete block wall - 3M #5300-IMP2.
 - 6.2.2 One hour fire rated gypsum wallboard - 3M #5300-IMP4.
 - 6.2.3 HVAC ducts penetrating a one or two hour fire rated wall or floor shall be firestopped per 3M #5300-HVD1.

- 6.2.4 Multiple pipes penetrating fire rated floors and walls may be firestopped as a group. Submit 3M details for specific applications if this method of firestopping is chosen.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 201200 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall include all excavating, filling, grading, and related items required to complete their work as shown on the drawings and specified herein or as required to complete, connect and place all mechanical systems in satisfactory operation.
- 1.3 Unless otherwise shown or required, provide separate trenches for sewers, water lines and other underground raceways, with a minimum of 10 feet measured from outside diameter between pipes. In locations, such as close to buildings where separate trenches for sewers and water lines are impractical, lay the water pipe on a solid shelf at least 2'-0" above the top of the sewer and 2'-0" to the side. All exterior lines shall have a minimum earth cover of thirty six (36) inches to top of pipe, unless otherwise indicated.
- 1.4 Water lines crossing under sewer lines, or crossing less than 2 feet above sewer lines, must be encased for a distance not less than 5 feet on either side of the point of crossover.

PART 2 - EARTH AND ROCK CLASSIFICATION:

- 2.1 Materials to be excavated shall be unclassified, and shall include earth, rock, concrete or any other obstructions encountered in trenching to install underground utility pipes. Include all costs for rock removal, including mass rock and trench rock in the bids. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.
- 2.2 Refer to Division 312000 - Earthwork and the Civil Drawings for additional information.
- 2.3 The contractor shall be responsible for the removal of all materials encountered as required for the installation of the work.
- 2.4 Without regard to the materials encountered, all excavation and materials excavated shall be unclassified. It shall be distinctly understood that references to rock, earth, topsoil or any other excavated or non-excavated material or other material on the construction plans, cross section, contract documents, technical specification or provisions, whether in numbers, words, letters, lines or graphically shown, is solely for information for the Engineer and Owner. This information shall not be taken as an indication of the classification of the material to be excavated, bored or removed by any method, including drilling and blasting, or materials not removed. This information shall not be taken as to the quantity of either rock, earth, topsoil, or any other material involved, or the quality of the material such as hardness, wetness, workability or suitability of the material either during excavation and construction or as a material to be reused during construction.
- 2.5 The contractor shall draw his own conclusions as to the surface and sub-surface conditions to be encountered during construction of this project. The Engineer and Owner does not give any guarantee or warranty as to the accuracy of the data shown and no claim will be considered for additional compensation when the materials encountered are not in accord with the information shown.

PART 3 - BENCH MARKS AND MONUMENTS:

- 3.1 Maintain carefully all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.

PART 4 - EXCAVATION:

- 4.1 Excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds 10 feet, keep the trench at the level of the top of the pipe as narrow as practical. Trench excavation for piping eight inches and smaller shall not exceed thirty inch width for exterior lines and twenty-four inch width for interior lines. Excavate to 6" below the bottom of new pipes for installation of compacted grillage.
- 4.2 Sheet and brace trenches as necessary to protect workers and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., and current OSHA Standards. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. Where removal of sheeting and/or bracing is hazardous, leave in place. Cut off such sheeting not to be removed at least 3 feet below finished grade.
- 4.3 Rules and regulations governing the respective utilities shall be observed in executing all work under this heading. Active utilities discovered in the course of excavation shall be protected or relocated in accordance with written instructions from the Engineer. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. If in doubt, contact Engineers. Machine excavation shall not be allowed within ten (10) feet of existing electric lines or lines carrying combustible materials. Use only hand tools.
- 4.4 The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Engineer. Any damage to existing structures, exterior services, or rock intended for bearing, shall be corrected at the responsible Contractor's expense.
- 4.5 Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to insure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and jointmaking. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell or flange and/or is supported with blocks or wedges will not be accepted.
- 4.6 Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipe. Any dewatering from this Contractor's trenches which is required during construction, shall be included in this Contract.
- 4.7 In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility lines, large trees to remain, etc. The Contractors shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred in the course of excavation shall be borne by the responsible Contractor.
- 4.8 Use surveyor's level to establish elevations and grades.
- 4.9 Machine excavation shall be held a sufficient distance from foundations and footings to insure no damage to same. Contractors shall accept full responsibility and pay for repairs and/or replacement of structural members, footings, etc.

- 4.10 The Contractor shall accept the site as it is and remove all trash, rubbish and material from the site prior to starting excavation work.
- 4.11 The Contractor shall provide and maintain barricades and temporary bridges around excavations as required for safety. Temporary bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these bridges in a safe and passable condition for all traffic until removal. Refer to OSHA Standards for such installations and comply with same in all details.
- 4.12 Pay particular attention to existing utilities and lines to avoid damage. The locations of existing lines which are indicated on the plans were taken unconfirmed from drawings prepared for previous construction and locations are approximate only. Also, certain water, gas, electric, storm and sanitary sewer lines and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be each Mechanical Contractor's responsibility to ascertain the location of all lines and excavate with caution in their area.
- 4.13 Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

PART 5 – BACKFILL, COMPACTION AND SURFACE REPAIR:

- 5.1 Backfilling for mechanical work shall include all trenches, manhole pits, storage tank pits, and/or any other earth and/or rock openings which are excavated under this Contract. Backfilling shall be carefully performed and the surface restored to its original level to receive new finish. Wherever trenches and earth openings have not been properly filled and/or settlement occurs, they shall be re-excavated, re-filled and properly compacted, smoothed off and finally made to conform to the level of the original ground surface.
- 5.2 All trenches shall be backfilled with 6" of manufactured sand or #8 crushed stone after finished excavation. Install the new pipe on the compacted fill material. Install tracer wire on pipe. Apply any special coatings to the pipe at this point. Also perform all required pressure tests and check the grade of the pipe to ensure that it is correct and free of swags, bows or bends. Once testing is complete, backfill the pipe bed to 12" above the top of the pipe with specified compacted fill material. Backfill the remainder of the trench with earth (debris and rock free) tamped at 6" intervals. Water settling of backfill is permitted only as an aid to mechanical compacting.
- 5.3 Backfill and compact beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean top soil.
- 5.4 Backfill and compact beneath paved areas, walks, etc. shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill or unstable soil.
- 5.5 Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.
- 5.6 Backfill and compaction for natural gas lines shall be in strict accordance with the local utility company or local municipality's requirements. If in doubt, contact the utility company or local municipality.
- 5.7 Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.
- 5.8 Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from off site shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.

- 5.9 In the absence (if not specified or indicated elsewhere in the drawings or specifications to be done by others) of such work by others, the Contractor shall lay new sod over his excavation work for existing disturbed grassy areas. Level, compress and water in accord with sound sodding practice.
- 5.10 **Compaction:** Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
- 5.10.1 At a minimum, fill in grass areas shall be compacted to 95% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Division 312000 – Earthwork; whichever is most stringent.
- 5.10.2 At a minimum, fill in concrete or asphalt area shall compacted to 98% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Division 312000 – Earthwork; whichever is most stringent.
- 5.11 Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- 5.12 **Grading:**
- 5.12.1 **Grading Outside Building Lines:**
- 5.12.1.1 All materials used for backfill around structures shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, large rocks, wood, and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls or other permanent work shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 8 inches in depth and shall be kept smooth as the work progresses. Each layer of the fill shall be compacted. Sections of the fill immediately adjacent to buildings or structures shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed so as to load structure symmetrically.
- 5.12.1.2 As set out hereinbefore, rough grading shall be held below finished grade and then the topsoil which has been stockpiled shall be evenly spread over the surface. The grading shall be brought to the levels shown on the Drawings. Final dressing shall be accomplished by hand work or machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than one inch in diameter. Excavated rock (1" and smaller) may be placed in the fills, but is shall be thoroughly covered. Rock placed in fills shall not be closer than 24 inches from finished grade.
- 5.13 **Maintenance:**
- 5.13.1 **Settling:** Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 5.14 **Disposal of Excess Non-organic Soil and Rock:**
- 5.14.1 Unless otherwise directed, excess topsoil and subsoil suitable for fill shall remain the property of the Owner and be stockpiled by the Contractor on-site where directed.

5.14.2 General: Any excess excavated waste material shall become the property of the Contractor and shall be disposed of by the Contractor at no additional cost to the Owner.

PART 6 - MINIMUM DEPTHS OF BURY (TO TOP OF PIPE):

6.1 In the absence of other indication, the following shall be the minimum depth of bury to top of pipe of exterior utility lines. (Check drawings for variations).

6.1.1 Domestic Water Lines 36 inches below final grade.

6.1.2 Sanitary Lines (Exterior) 36 inches below final grade.

6.1.3 All Other Lines Not Listed 36 inches below final grade.

6.2 The minimum bury depth based on initial grade shall be 30 inches.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 201300 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The piping indicated shall be installed complete and shall be of the size indicated. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineers. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.
- 1.3 All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted. Spacing of pipe supports shall not exceed eight feet for pipes up to 3 inches and ten feet on all other piping. Small vertical pipes (1 inch and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. (Refer to Specifications Section entitled INSULATION-MECHANICAL.)
- 1.4 Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation.
- 1.5 Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.
- 1.6 Plastic piping or any material with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.
- 1.7 Dielectric couplings or nipples shall be provided at all connections of dissimilar materials.
- 1.8 In general, piping shall be installed concealed except in Mechanical, Janitor Rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.
- 1.9 Unless otherwise indicated, all materials shall be new and of the best grade and quality for the type specified.

- 1.10 Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be ½" size gate type with ¾" hose thread end and vacuum breaker. Label each drain valve.
- 1.11 Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and tapped with a hammer to remove scale and dust and inspected to insure that no foreign matter is lodged therein.
- 1.12 All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.
- 1.13 Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing; if in doubt, consult Engineer.
- 1.14 Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and sound practice.
- 1.15 All increases in vent size at roof shall be by means of service weight cast iron increasers.
- 1.16 Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineers.
- 1.17 Nipples shall be of the same material, composition and weight classification as pipe with which installed.
- 1.18 Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineers prior to submission of a bid proposal.
- 1.19 Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If necessary, contact Engineers.
- 1.20 Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.
- 1.21 Apply approved pipe dope (for service intended) to all male threaded joints. The dope shall be listed for such use.
- 1.22 Eccentric reducers shall be used where required to permit proper drainage and venting of pipe lines; bushings shall not be permitted.
- 1.23 All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.
- 1.24 The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State in which the work is being accomplished.
- 1.25 The entire sanitary waste and vent piping system within the building shall be air-tight. If any sewer gases are present within the building, it is the contractor's responsibility to locate and correct this problem completely, and re-tested. Any odor problems within a one year after substantial completion is the responsibility of the contractor to correct.

- 1.26 Site water piping utilized for domestic service shall be filled, cleaned and disinfected. Disinfection shall utilize chlorine per the local water company standards. Hyper-chlorinated water shall be discharged (and diluted if required) at the end of the pipeline into the sanitary sewers per local utility regulations.

PART 2 - UNIONS AND FLANGES AND WELDED TEES:

- 2.1 Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.
- 2.2 Dielectric insulating nipples or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.
- 2.3 Tee connections for welded pipe shall be made up with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

PART 3 - SPECIFICATIONS STANDARDS:

- 3.1 All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:
- 3.1.1 Steel pipe; ASTM A-53.
- 3.1.2 Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
- 3.1.3 Cast iron soil pipe; ASA A-40.1 and CS 188-59.
- 3.1.4 Cast iron drainage fittings; ASA B16.12.
- 3.1.5 Cast iron screwed fittings; ASA B16.4.
- 3.1.6 Welding fittings; ASA B16.9.
- 3.1.7 Cast brass and wrought copper fittings; ASA B16.18.
- 3.1.8 Cast brass drainage fittings; ASA B16.23.
- 3.1.9 Solder; Handy and Harmon, United Wire and Supply; Air Reduction Co. or equivalent.

PART 4 - PITCH OF PIPING:

- 4.1 All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:
- 4.2 Interior Soil, Waste and Vent Piping: ¼ inch per foot in direction of flow where possible but in no case less than 1/8" per foot.
- 4.3 Exterior Sanitary Lines: Not less than one (1) percent fall in direction of flow and no greater than indicated.

- 4.4 Condensate Drain Lines From Cooling Equipment: Not less than ¼ inch per foot in direction of flow.
- 4.5 Exterior Storm Lines: Not less than 1 percent grade in direction of flow.
- 4.6 All Other Lines: Provide ample pitch to a low point to allow 100 percent drainage of the system.

PART 5 – APPLICATIONS:

5.1 Sanitary Sewer – Exterior:

- 5.1.1 Refer to Civil Plans and Specifications.

5.2 Storm Sewer – Exterior

- 5.2.1 Refer to Civil Plans and Specifications.

5.3 Domestic Water Piping - Exterior

- 5.3.1 Refer to Civil Plans and Specifications.

5.4 Soil, Waste and Vent Piping (Below Slab)

- 5.4.1 Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code. PVC pipe will not be allowed in boiler rooms unless otherwise stated on the construction documents.

5.5 Soil, Waste and Vent Piping (Above Slab)

- 5.5.1 Type DWV copper drainage piping with cast bronze drainage pattern fittings with solder joints.
- 5.5.2 Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing code.

5.6 Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)

- 5.6.1 Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).

5.7 Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab)

- 5.7.1 Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.

5.8 Water Heater Relief Line

- 5.8.1 Type "M" copper tubing with sweat fittings and 95/5 solder.

5.9 Site Sanitary Sewer - Force Main:

- 5.9.1 Ductile cast iron pipe shall conform to ANSI A21.51 and AWWA C151. All ductile cast iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C150 requirements.
- 5.9.2 Ductile cast iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coat on the inside in accordance with ANSI A 21.4 requirements. Thickness of the lining shall be as set out in

aforesaid specification. Pipe and fittings shall have standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil thick.

- 5.9.3 Fittings for ductile cast iron pipe shall be mechanical joint Class 250 gray iron conforming to ANSI A21.10 and AWWA C110 for short body cast iron fittings. Fittings shall be bituminous coated outside and shall receive the standard cement mortar lining with bituminous seal coat on the inside as specified hereinbefore.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202100 - VALVES AND COCKS

PART 1 – GENERAL:

- 1.1 Each Mechanical Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- 1.2 Each Mechanical Contractor (and/or Sub-Contractors) shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing cocks, air cocks, lubricated plug cocks, packed plug cocks, special valves for special systems, etc., for all Mechanical Systems.
- 1.3 All valves shall be designed and rated for the service to which they are applied.
- 1.4 The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.
- 1.5 Each type of valve shall be of one manufacturer, i.e., gate valves, one manufacturer, globe valves, one manufacturer, silent check valves, one manufacturer, etc.. The following valve manufacturers shall be acceptable: Lunkenheimer, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Bell & Gossett, Apollo.
- 1.6 All valves shall comply with current Federal, State and Local Codes.
- 1.7 All valves shall be new and of first quality.
- 1.8 Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

PART 2 - TYPES AND APPLICATION - DOMESTIC WATER:

- 2.1 Globe Valves (2" and under): Globe Valves shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 150 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 2.2 Check Valve (2" and under): Check valve shall have bronze body, disc and hinge. check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 2.3 Ball Valve (2" and under): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends.
- 2.4 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.
- 2.5 Pressure Reducing Valves: Watts #U5B water pressure reading valve with bronze body, bolted bonnet, integral stainless steel strainer and outlet water pressure gauge. Internal disc, diaphragm and stainless steel seat shall all be removable. Valve shall be rated for inlet water pressures up to 300 psi. Water pressure

- reducing valves shall be provided for all equipment where water pressure exceeds the equipment manufacturer's ratings.
- 2.6 Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.
- 2.7 Double Check Valve: Double check valve shall have bronze body construction and be provided with inlet strainer, (2) gate valves for isolation and (3) test ports. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. Assembly must meet requirements of AWWA Standard C506. Provide Watts #900 with threaded ends for sizes 2" and less. For sizes over 2" provide Watts #709 with flange ends.
- 2.8 Reduced Pressure Backflow Preventers: Watts #909 reduced pressure backflow preventers shall be provided with inlet strainer, (2) gate valves for isolation, (3) test ports and air gap fitting. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. RPBP shall be UL listed and meet AWWA C511 standards. All valves 3" and less in size shall bronze body construction, over 3" in size shall have epoxy coated cast iron bodies. Assemblies 2" and under in size shall have threaded ends, over 2" in size shall have flange ends.
- 2.9 Balancing Valve: Bell & Gossett "Circuit Setter" Model CB or equal balancing valve. All valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts and check valves. Valve bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202200 - INSULATION - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- 1.2 Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.
- 1.3 Application of insulation materials shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use. Insulation shall be applied by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineers shall be removed and properly installed at the expense of the Contractor.

PART 2 – MANUFACTURERS:

- 2.1 Insulation shall be as manufactured by Manville, Keene Corp., Knauf, Owens-Corning, Armstrong, World Industries or other approved equivalent. Insulation sundries and adhesives shall be as made by Benjamin Foster, Childers, Vimasco or approved equivalent.

PART 3 - FIRE RATINGS AND STANDARDS:

- 3.1 Insulations, jackets and facings shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.
- 3.2 Adhesives, mastics, tapes and fitting materials shall have component ratings as listed above.
- 3.3 All products and their packaging shall bear a label indicating above requirements are not exceeded.

PART 4 - GENERAL APPLICATION REQUIREMENTS:

- 4.1 Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.
- 4.2 Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.
- 4.3 All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.
- 4.4 "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed"

as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

- 4.5 Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.
- 4.6 Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!
- 4.7 All insulation shall be installed with joints butted firmly together.
- 4.8 The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

PART 5 - PIPING SYSTEMS:

5.1 GENERAL

- 5.1.1 Bevel insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. Note: Applies to hot water lines only; cold water lines require continuous insulation.
- 5.1.2 Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.
- 5.1.3 Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.
- 5.1.4 Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool.

5.2 INSULATION SHIELDS AND INSERTS

- 5.2.1 Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 ° arc. Insulation shields shall be the following size:

PIPE SIZE	SHIELD GAUGE	SHIELD LENGTH
2" AND LESS	20	12"
2 1/2" TO 4"	18	12"
5" TO 10"	16	18"
12" AND GREATER	14	24"

- 5.2.2 Insulated pipes 2" in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond extend beyond the hanger and shall be at least 6" in length.

5.3 PREMOLDED INSULATION FITTING COVERS

5.3.1 Provide PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One addition insert shall be used for each additional 1" of pipe insulation above 1-1/2".

5.4 INSULATION MATERIAL (FOR THE FOLLOWING SYSTEMS)

Insulation shall be Owens-Corning Model 25ASJ/SSL or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of .02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer's recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

5.4.1 Domestic Water Systems:

- | | | |
|---------|--|---------------------|
| 5.4.1.1 | Domestic Cold Water - | 1" thick insulation |
| 5.4.1.2 | Hydronic System Fill Lines From Domestic Cold Water - | 1" thick insulation |
| 5.4.1.3 | Domestic 110°F Hot Water and 110°F Recirculating Hot Water - | 1" thick insulation |

5.5 JACKETS

5.5.1 Exposed (Mechanical Rooms, Interior Finished Rooms and Storage Rooms):

5.5.1.1 All insulated piping installed within 8' of the finished floor, in the above areas shall have a 6 oz. canvas jacket with fire retardant lagging apply to the insulation specified for the piping.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202300 - THERMOMETERS, PRESSURE GAUGES AND
OTHER MONITORING INSTRUMENTS

PART 1 - GENERAL:

- 1.1 The Mechanical Contractor(s) shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated.
- 1.2 All thermometers, pressure gauges and/or compound gauges shall be provided with "PET Cocks" to allow the gauge to be removed and replaced without shutting down system.

PART 2 - THERMOMETERS AND PRESSURE GAUGES:

- 2.1 All thermometers and pressure gauges shall be readable from a standing position on the floor.
- 2.2 Water thermometers shall be Bimetal type with 3" dial, stainless steel case, stainless steel stem and socket with length as required by piping system. Accuracy to be plus or minus 1%. Lens to be plastic. Hot water thermometer shall have a 30°F to 240°F range and chilled water thermometer shall have a 25°F to 125°F range. (Marsh Master Therm or equal.)
- 2.3 Pressure gauges shall be Bourdon Type, circular, 2-1/2" face, black letters on white face graduated in 2 PSI or less and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks. Accuracy to be plus or minus 2%. Water pressure and low pressure steam gauges shall have 0 to 100 PSI range and medium/high pressure steam gauges shall have 0 to 200 PSI range. (Marsh Acculite II or equal.)
- 2.4 Provide direct mount Bimetal dial thermometers in HVAC ductwork. Thermometer shall be 3" diameter, with acrylic plastic lens and stainless steel case. Air temperature range shall be 25°F to 125°F. (Marsh Master Therm or equal.)
- 2.5 Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc. with flexible tubing.
- 2.6 Mount thermometers in approved wells. Do not make direct contact of base with fluid in pipe.
- 2.7 Gauges and thermometers shall be Marsh, Marshalltown, Terice, Weksler or equivalent.

PART 3 - PRESSURE/TEMPERATURE TEST STATION (PETES PLUG):

- 3.1 Provide 1/4" NPT fitting to receive either a temperature or pressure probe, 1/8" OD. Fitting shall be solid brass with two valve cores. (Valve core material to be Neoprene for temperatures up to 200°F and Nordel for temperatures between 200°F and 275°F.). Petes Plugs to have 3" length when installed on insulated pipes and 1-1/2" length for uninsulated pipes. Petes Plug to be fitted with a color coded cap strap with gasket, and shall be rated at 1000 PSIG at 140°F. In addition, the installing contractor shall supply the owner (4) pressure gauges with 1/8" OD probe and (4), five-inch stem pocket testing thermometers rated for 25-125°F chilled water and 4, 0-200°F hot water thermometers.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

PART 1 – GENERAL:

1.1 Each Mechanical Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

PART 2 - PIPING IDENTIFICATION:

2.1 All piping installed shall be identified according to the chart hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping shall be identified on 6 foot centers. All piping shall be minimally identified once above all room ceilings and where it passes thru walls or floors. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking. The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

OUTSIDE DIAMETER OF PIPE OR COVERING	LENGTH OF COLOR FIELD	SIZE OF LETTERS
INCHES	INCHES	INCHES
3/4 TO 1 1/4	8	1/2
1 1/2 TO 2	8	3/4
2 1/2 TO 6	12	1 1/4
8 TO 10	24	2 1/2
OVER 10	32	3 1/2

- 2.1.1 DCW Domestic Cold Water
- 2.1.2 DHW Domestic Hot Water (120 °F)
- 2.1.3 RHW Recirculating Hot Water (120 °F)

PART3 - EQUIPMENT IDENTIFICATION:

3.1 Unless otherwise specified, all equipment shall be identified with the title of the equipment as taken from the plans in a position that is clearly visible from the floor. The equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 2” high white letters on the front of each piece of equipment. **All mechanical equipment shall have the electrical panel number and circuit number identified on the lamacoid plate.** Coordinate with the electrical contractor.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Provisions - Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Section 201300, Pipe, Pipe Fittings and Pipe Support.
- 1.3 This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.
- 1.4 Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

PART 2 - MATERIALS AND EQUIPMENT:

2.1 Hangers, Clamps, Attachments, Etc.:

	SIZE	SPECIFICATION
1. Pipe Rings	2" pipe and smaller	Adjustable swivel split ring or split pipe ring, Grinnell Figures 104 and 108, Elcen, Fee & Mason, or approved equivalent.
2. Pipe Clevis	2-1/2" pipe and larger	Adjustable wrought Clevis type, Grinnell Figure 260, Elcen, Fee & Mason, or approved equivalent.
3. Pipe Clevis	All	Steel Clevis for insulated pipe, Elcen Figure 12A, Grinnell, Fee & Mason or approved equivalent.
4. Rise Clamps	All	Extension pipe or riser clamp, Grinnell Figure 261, Elcen, Fee & Mason or approved equivalent.
5. Beam Clamps and Attachments	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason, or approved equivalent. Malleable beam clamp with extension piece figure 229; I-beam clamp figure 131; C-clamp figures 83, 84, 85, 86, 87, and 88.
6. Brackets	All	Welded steel brackets medium weight, Grinnell Figure 195, Elcen, Fee & Mason or approved equivalent.

7. Concrete Inserts	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason or approved equivalent. Wrought steel insert Figure 280 and wedge type insert Figure 281.
8. Concrete Fasteners	All	Self-drilling concrete inserts, Phillips, Grinnell, Elcen or approved equivalent.
9. Trapeze Hangers	All	Approved by Engineer
10. Rod Attachments	All	Grinnell Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Extension piece Figure 157, rod coupling Figure 136, and forged steel turnbuckle Figure 230.
11. U-Bolts	All	Standard, U-bolt, Grinnell Figure 137, Elcen, Fee & Mason, or approved equivalent.
12. Welded Pipe Saddles	All	Pipe covering protection saddle sized for thickness of insulation, Grinnell Figure 186, Elcen, Fee & Mason or approved equivalent.
13. Pipe Roll	All	Adjustable swivel pipe roll, Grinnell Figure 174, Elcen, Fee & Mason, or approved equivalent.
14. Protection Saddle	All	Sheet metal pipe protection saddle (See Specification Section 202200, Elcen Figure 219, Fee & Mason, Power Strut, or approved equivalent.
15. Hanger Rods	All	Steel, diameter of the hanger threading, ASTM A-107.
16. Miscellaneous Steel	All	Steel angles, rods, bars, channels, etc., used in framing for supports and fabricated brackets, anchors, etc., shall conform to ASTM-A-7.
17. Concrete Channel Inserts	All	Heavy duty or Light Duty Series as required.
18. Adjustable Spot Insert	All	Adjustable spot insert. Design load 1000 lbs.

PART 3 – INSTALLATION:

- 3.1 Unless otherwise specifically indicated or hereinafter specified in the specifications, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be done by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs:
- 3.2 Supporting and hanging shall be done so that excessive load will not be placed on any one hanger so as to allow for proper pitch and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns and branches.

- 3.3 For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.
- 3.4 Trapeze hangers are not allowed, unless specifically approved by the engineer.
- 3.5 Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.
- 3.6 Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.
- 3.7 Where piping, etc., is run vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.
- 3.8 Where piping is run along walls, knee braced angle frames or pipe brackets with saddles, clamps, and rollers (where required) mounted on structural brackets fastened to walls or columns shall be used.
- 3.9 Support all ceiling hung equipment, with approved vibration isolators.
- 3.10 Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.
- 3.11 Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.
- 3.12 All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.
- 3.13 Under no conditions will perforated band iron or steel wire driven hangers be permitted.
- 3.14 In general, support piping at the following spacing:
 - 3.14.1 Steel and copper piping - 8 foot intervals for piping 3" and smaller; 10 foot intervals for larger piping.
 - 3.14.2 Schedule 40 plastic pipe: Shall be supported at intervals not to exceed four (4) feet and at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

PART 1 – GENERAL:

- 1.1 The General Conditions, Instructions to Bidders, General Provisions - Mechanical, and other Contract Documents are a part of this specification and shall be binding on all Mechanical Contractors and sub-contractors. It shall be each Contractor's responsibility to apprise himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.
- 1.2 The Engineer, or his authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these specifications or required by others. Any leaks or imperfections found shall be corrected and a new tests run to the satisfaction of the Engineer or his authorized representative. Upon completion of a test, a written approval of that part of the work will be given to the Contractor. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow his work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.
- 1.3 RELATED DOCUMENTS
 - 1.3.1 All Division 20 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.
- 1.4 SCOPE OF WORK
 - 1.4.1 The owner will directly contract with a certified testing, adjusting, and balancing (TAB Agency) to test, adjust, and balance the HVAC systems. The plumbing and fire protection requirements noted hereinafter shall be provided by the responsible contractor.
 - 1.4.2 This specification section is included herein to assist and inform the Contractor of the standards, requirements and scope of the work to be performed by the Owner's TAB Contractor.

PART 2 – PLUMBING:

- 2.1 Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- 2.2 Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.
- 2.3 The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.
- 2.4 Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.
- 2.5 After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.

- 2.6 Thermometers and gauges shall be checked for accuracy. If instruments prove defective, they shall be replaced.
- 2.7 The Contractor shall perform all additional tests that may be required by the Department of Health or other governing agency.
- 2.8 Set temperature control on water heaters and adjust tempering valves as required.
- 2.9 Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM.
- 2.10 Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

PART 3 - PREPARATION AND COORDINATION REQUIREMENTS – GENERAL

- 3.1 System installation and equipment startup shall be complete prior to the TAB Agency's being notified to begin.
- 3.2 The building control system shall be complete and operational. The Building Control system contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- 3.3 All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- 3.4 Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

PART 4 - PREPARATION AND COORDINATION REQUIREMENTS – HVAC CONTROLS

- 4.1 Written notice shall be submitted through the Construction Manager to the Architect stating that the Control System is operating and controlling the HVAC System.
- 4.2 The control subcontractor shall have entered all data needed for the TAB Agency to begin work.
- 4.3 The Control subcontractor shall be available to correct any problems that the TAB Agency might have with the systems.
- 4.4 All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for HVAC controls.

PART 5 - PREPARATION AND COORDINATION REQUIREMENTS – MECHANICAL

- 5.1 Written notice shall be submitted through the Construction Manager stating that the HVAC system is operational and ready for the TAB Agency.
- 5.2 The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.

- 5.3 The Mechanical subcontractor shall have proved all units operational and all air outlets in the full open position.
- 5.4 The Mechanical Contractor shall be available to correct any problems that the TAB Agency might have with any equipment or systems.
- 5.5 The control subcontractor shall have entered all data needed for the TAB Agency to begin work.
- 5.6 The Control subcontractor shall be available to correct any problems that the TAB Agency might have with the systems.
- 5.7 All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated. Provide all start-up documents to Designer prior to any test and balance services.
- 5.8 The Mechanical Contractor shall furnish and install any replacement sheaves, pulleys and drive belts required for flow adjustments, as determined by the TAB Agency. Adjustable sheaves shall be selected so that the final adjustment position is in the middle third of the total adjustment range.
- 5.9 All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for mechanical work.

PART 6 - WORK BY TAB AGENCY

- 6.1 The following is the scope of work for the Test and Balance Contractor. Reference only:
 - 6.1.1 Balance all exhaust air grilles to within 10% of design air flow rate.
 - 6.1.2 Balance all exhaust air fans and record inlet static pressure.
 - 6.1.3 Balance domestic hot water return system including all balance valves and record settings and flows.

PART 7 - DEFINITIONS, REFERENCES AND STANDARDS

- 7.1 All work shall be in accordance with the latest edition of the National Standards, as published by the National Organization affiliated with the TAB Agency.

END OF SECTION.

DIVISION 22 - PLUMBING

SECTION 220100 - PLUMBING SPECIALTIES

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work specified in this section.
- 1.2 The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the State Plumbing Code.
- 1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- 1.4 All equipment and specialties shall be new unless other wise indicated or specified. They shall also be of equivalent quality, dimensions, material, etc. as those specified.
- 1.5 All equipment and specialties shall be installed as recommended by the manufacturer.
- 1.6 Prior to final inspection, test by operation at least twice, all equipment.
- 1.7 Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.
- 1.8 All equipment and specialties shall be installed in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.

PART 2 - DRAINAGE SPECIALTIES:

- 2.1 General: Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors. Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected. Drainage specialties shall be installed in a manner so as to insure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.
- 2.2 Cleanouts – Interior (CO): In addition to cleanouts indicated, provide cleanouts in soil and waste piping and storm drainage at the following minimum locations:
 - 2.2.1 At base of each stack.
 - 2.2.2 At fifty (50) foot maximum intervals in horizontal lines.
 - 2.2.3 At each change of direction of a horizontal line.
 - 2.2.4 As required by current State Plumbing/Building Codes.
 - 2.2.5 As required to permit rodding of entire system. (If in doubt, contact Engineers.)
 - 2.2.6 Water closets, slop sinks and other fixtures with fixed traps shall not be accepted as cleanouts.

- 2.2.7 Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.
- 2.2.8 Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Wade. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's option, be Perma-Coated steel, prepared to receive finish.
- 2.2.9 Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.
- 2.2.10 Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.
- 2.2.11 Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.
- 2.2.12 In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.
- 2.2.13 Cleanouts shall be as manufactured by Zurn, Josam, Wade, Ancon, Jay R. Smith, similar to the following:
- 2.2.13.1 Zurn, Z-1440 cleanouts or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.
- 2.2.13.2 Zurn, Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls.
- 2.2.13.3 Zurn, ZN-1400-T cleanout with square scoriated top in finished concrete and masonry tile floors.
- 2.2.13.4 Zurn, ZN-1400-Tx cleanout with square recessed top for tile in vinyl and linoleum finished floors.
- 2.2.13.5 Zurn, ZN-1400-Z cleanout with round recessed top for terrazzo floors.
- 2.2.13.6 Zurn, Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water. Refer to drawings for pad size.
- 2.2.13.7 Mueller, No. D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.
- 2.2.13.8 Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.
- 2.2.13.9 Zurn, cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.
- 2.3 Floor Drains: Provide floor drains at locations indicated and/or as required by State Plumbing/Building Codes. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to insure floor pitch to drain where required.
- 2.3.1 Install floor drains in strict accordance with manufacturer's recommendations and the State Plumbing and Building Codes unless otherwise indicated.
- 2.3.2 Each floor drain located on floors above the lowest floor shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar or chlorinated polyethylene shower pan liner of 30 mil. Lead pans shall be given a heavy coat of asphaltum on bottom and sides before

- installation and a heavy coat on exposed surfaces (if any). After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.
- 2.3.3 Insure by coordination with the appropriate persons or party that spaces served by a floor drain(s) has a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.
- 2.3.4 The floor drains shall be Zurn, Josam, Wade, Watts Drainage, Ancon or equivalent, similar to the following:
- 2.3.5 FD-1 - Zurn, ZN-415 floor drain with 6"dia. nickel bronze strainer, Type "B", dura-coated cast iron body with bottom 3" outlet. Provide with trap primer connection. Provide with 4" Sure Seal Model SS preassembled Inline Floor Drain Trap Sealer. Commercial grade ABS plastic housing and neoprene rubber diaphragm with 1 soft rubber sealing gaskets. Floor rating ASSE – 1072 AF-GW
- 2.4 Cleanouts (Exterior) (CO): Provide exterior cleanouts at each location indicated and in the manner indicated. Permanently locate all exterior cleanouts with four (4) by four (4) inch solid concrete marker flush with grade labeled "CO". Exterior cleanouts shall be of the type indicated.
- 2.5 Water Supply Specialties: Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in a neat and workmanlike manner in accordance with the manufacturer's recommendations and the Building Code.
- 2.5.1 Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.
- 2.6 Freezeproof Wall Hydrants (FPWH): Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and insure that the feed piping is on the heated side of the building insulation blanket.
- 2.6.1 Where hydrants are of handwheel type, remove handwheels and turn over to owners in an envelope labeled "Wall Hydrants" exterior upon completion of the project.
- 2.6.2 Where hydrants have key operators, turn over at least two (2) keys in an envelope labeled "Wall Hydrants" to owners upon completion of the project.
- 2.6.3 Where hydrants have lockable boxes, turn over at least two (2) keys in an envelope labeled "Wall Hydrants, Exterior" to owners upon completion of project.
- 2.6.4 Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineers.
- 2.6.5 Wall hydrants shall be as follows or equivalent:
- 2.6.5.1 Zurn 1320 or equivalent, 3/4", with half-turn ceramic cartridge, encased, flush, non-freeze, anti-siphon, automatic draining wall hydrant with key lock and combination backflow preventer/vacuum breaker.
- 2.7 Hose Bibbs (HB): Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated, in public toilet rooms and as follows:
- 2.7.1 Do not install hose bibbs in spaces which do not have existing planned or installed floor drains even if sill cocks are indicated for these areas.
- 2.7.2 Hose bibbs shall be mounted at eighteen (18) inches above finished floor served.

2.7.3 The hose bibbs shall be Woodford or equivalent similar to the following:

2.7.3.1 HB-Woodford Model BR24 with recessed housing with rough brass finish.

2.8 Boiler Drains (BD): Install 3/4 inch bronze body boiler drains, similar and equivalent to Nibco, No. 72 or 73, as indicated and at the following locations:

2.8.1 At the low point of the plumbing system.

2.8.2 In each hot water heater and/or storage tank.

2.8.3 On each water storage tank.

2.8.4 At each pump suction.

2.8.5 At the low point of each isolatable section of any system carrying water.

NOTE: Install a code approved vacuum breaker where installation on to domestic water system.

2.9 Water Hammer Arrestors (WHA): Provide water hammer arrestors at each location indicated and/or as required to eliminate hydrostatic on the domestic water system. Provide at least one water hammer arrestor at all quick acting valve locations including:

Automatic clothes washers – Type “A”

Mop Basins (downstream of check valve) – Type “A”

Flush valve fixtures – Type “B” (Each toilet room with 1-3 flush valve fixtures shall have its own Type “B” water hammer arrestor)

2.9.1 Multiple Fixtures – Branch Line Less Than 20’ Long: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures served when the branch lines do not exceed 20’ in length, from the start of the horizontal branch line to the last fixture supply on this line.

2.9.2 Multiple Fixtures – Branch Line More Than 20’ Long: On branch lines over 20’ in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

2.9.3 Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall not be acceptable.

2.9.4 Note: Provide insulating unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).

2.9.5 Schedule:

MARK	MANUFACTURER & MODEL	SIZE (FIXTURE UNITS)	P.D.I. SIZE
TYPE "A"	ZURN, Z-1700 #100	1-11	A
TYPE "B"	ZURN, Z-1700 #200	12-32	B
TYPE "C"	ZURN, Z-1700 #300	33-60	C
TYPE "D"	ZURN, Z-1700 #400	61-113	D

PART 3 - GENERAL SPECIALTIES:

- 3.1 Vacuum Breakers and Back Flow Preventers: Where required by the Building Code, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.
- 3.2 Where domestic water system connects to fire protection system.
- 3.3 At any hose (threaded) tap on the domestic water system.
- 3.4 At all mop basins, provide check valves to the hot and cold water supply upstream of the faucet.
- 3.5 Roof Flashings: All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the State Plumbing and Building Codes and as recommended by the roofing manufacturer and/or Contractor.

END OF SECTION.

DIVISION 22 - PLUMBING

SECTION 220200 - PLUMBING FIXTURES, FITTINGS AND TRIM

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.
- 1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- 1.4 Coordinate stainless steel sink with architectural casework shop drawings. Do not order sinks until this has been coordinated.
- 1.5 Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws. In general, furnish the following with manual loose key stop valves:
 - 1.5.1 Drinking Fountains
 - 1.5.2 Wall-hung Lavatories
 - 1.5.3 Hose Bibbs

For all other fixtures, furnish with manual permanent-key stop valves (ie. sinks in casework, etc.). When in doubt, contact Engineer prior to installation.
- 1.6 Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws.
- 1.7 All exposed piping, stops, traps, tailpieces, etc. shall be code approved chrome plated brass unless otherwise indicated or specified. Where acid resistant piping is indicated on the drawing or the specifications, all piping and ancillary components from the sink/lavatory to dilution basin shall be acid resistant acid specified and required by code.
- 1.8 All fittings, fixtures and trim shall be new unless otherwise indicated or specified. They shall also be of equivalent quality, dimensions, material, etc. as those specified.
- 1.9 Handicapped fixtures shall be mounted as recommended by the Ohio Building Code and ADA.
- 1.10 All fixtures shall be mounted as recommended by the manufacturer unless otherwise indicated or specified and so as to be rigid to walls and floors. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.
- 1.11 Prior to final inspection open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained.
- 1.12 Prior to final inspection, test by operation at least twice:
 - 1.12.1 (Where applicable) adequate flow of hot and/or cold water at;

- 1.12.1.1 All Faucets
 - 1.12.1.2 Flush Valves and Tanks
 - 1.12.1.3 Hose Bibbs
 - 1.12.1.4 Sill Cocks
 - 1.12.1.5 All Other Valved Hot and/or Cold Water Openings In the Plumbing System
 - 1.12.1.6 All toilet seats
 - 1.12.1.7 All flush tank overflows
- 1.13 Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.
- 1.14 All fixtures shall be set level and true and shall be grouted into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing grout for such service.
- 1.15 Special Note for Handicap Grab Rails: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal and service without removal of the grab bar.
- 1.16 Available Manufacturers: Subject to compliance with requirement's manufacturers offering plumbing fixtures and trim which may be incorporated in the work include the following:
- 1.16.1 Plumbing Fixtures - Water Closet, Lavatory and Urinal
 - 1.16.1.1 American Standard, U.S. Plumbing Products
 - 1.16.1.2 Briggs
 - 1.16.1.3 Crane Plumbing
 - 1.16.1.4 Eljer Plumbingware Div., Wallace-Murray Corp.
 - 1.16.1.5 Kohler Co.
 - 1.16.1.6 Universal-Rundle
 - 1.16.1.7 Zurn
 - 1.16.2 Plumbing Trim
 - 1.16.2.1 American Standard, U.S. Plumbing Products
 - 1.16.2.2 Chicago Faucet Co.
 - 1.16.2.3 Kohler Co.
 - 1.16.2.4 Delta Co.
 - 1.16.2.5 T&S Brass & Bronze Work Co.
 - 1.16.2.6 Just Co.
 - 1.16.2.7 Speakman Co.
 - 1.16.2.8 Zurn Aqua-Spec
 - 1.16.3 Flush Valves
 - 1.16.3.1 Sloan Valve Co.
 - 1.16.3.2 Zurn Co.
 - 1.16.3.3 Delaney
 - 1.16.4 Fixture Seats
 - 1.16.4.1 Bemis Mfg. Co.
 - 1.16.4.2 Church Seat Co.
 - 1.16.4.3 Olsonite Corp., Olsonite Seats

1.16.5 Fixture Carriers

- 1.16.5.1 Josam Mfg. Co.
- 1.16.5.2 Kohler Co.
- 1.16.5.3 Tyler Pipe
- 1.16.5.4 Zurn Industries
- 1.16.5.5 Wade

1.16.6 Ice Machine Connection Box

- 1.16.6.1 Guy Gray Co.
- 1.16.6.2 Oatley, Inc.
- 1.16.6.3 Wolverine Brass, Inc.

PART 2 – SELECTION

P-1 Water Closet – Flush Valve, Wall Mounted – ADA Height

Zurn model Z5615-BWL vitreous china, elongated rim, siphon action water closet. Provide 1½” top spud, solid plastic elongated seat with open front, extended back, and check hinge. Provide with concealed carrier. Mount seat at 18” AFF. Install flush valve on “open” side of water closet. Water closet flush valve shall be as follows:

- Manual ADA flush valve shall be Zurn model Z6000-WS1. Top of flush valve handle shall be a maximum of 31-1/4” A.F.F.

P-2 Lavatory – Wall-hung, Backsplash – ADA Compliant

Zurn model Z5344, 20”x18” vitreous china lavatory with backsplash, rectangular basin, splash lip, front overflow, and 4” center faucet holes. Provide with concealed arm support and wall carrier. Provide lavatory drain with integral perforated strainer, 3/8” angle rigid supplies with stops and P-trap. Install insulation on the supply lines and P-trap similar to Brocar “Trap Wrap” vinyl plastic covering per ADA Standards. Mounting height to be per ADA. Lavatory trim shall be as follows:

- Self-metering faucet shall be Zurn model Z86100-CP4-3M with polished chrome-plated cast brass body, single inlet, 3-3/4” centerline spout, and vandal resistant push-button handle. Furnish with vandal resistant 0.5 GPM aerator and 4” cover plate. Furnish and install Wilkins model ZW3870 tempering mixing valve.

P-3 Ice Maker Connection Box

IPS Corporation Water-Tite mini round ice maker outlet box with integral water hammer arrestor and preloaded nails. Connect cold water supply line to water supply at adjacent sink. Field paint exposed portions of box to match adjacent wall surfaces.

P-4 Drinking Fountain – ADA - Exterior

Elkay model LK4430BF1U barrier free, bi-level, pedestal mounted drinking fountain with bottle filler. Fountain shall have powder coated steel finish, stainless steel bowls, heavy duty galvanized welded steel pedestal, front mounted self-closing activation buttons, polished chrome non-squirt bubblers, and vandal resistant access door.

P-5 Drinking Fountain – ADA – Exterior, Wall Hung

Elkay model LK4405 barrier free, single level, wall mounted drinking fountain. Fountain shall have powder coated steel finish, stainless steel bowl, heavy duty galvanized welded steel wall bracket, front mounted self-closing activation buttons, polished chrome non-squirt bubblers, and vandal resistant access door.

END OF SECTION.

DIVISION 23 - HVAC

SECTION 230200 - HVAC EQUIPMENT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- 1.2 The Contractor shall provide in complete working order the following heating, ventilation and air conditioning equipment located as indicated and installed, connected and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.
- 1.3 All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90 and all provisions of the International Energy Conservation Code.
- 1.4 Note to Suppliers and Manufacturers Representative furnishing proposals for equipment for the project:
 - 1.4.1 Review the Controls Section of these Specifications (if applicable) to determine controls to be furnished by the equipment manufacturer, if any.
 - 1.4.2 All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.
 - 1.4.3 Review the section of these specifications entitle: REQUIRED SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS, TOOLS, ETC., and provide all documents called for therein.
 - 1.4.4 Ensure that the equipment which you propose to furnish may be installed, connected, placed in operation and easily maintained at the location and in the space allocated for it.
 - 1.4.5 Review all documents as indicated in Paragraph "1.1" preceding.
 - 1.4.6 Determine from the Bid Documents the date of completion of this project and insure that equipment delivery schedules can be met so as to allow this completion date to be met.
 - 1.4.7 Electric motors shall be furnished with the equipment and shall be of the size and type scheduled or otherwise specified. All motors shall be UL labeled and shall comply with applicable NEMA standard. Motors shall be high efficiency type. Refer to Section 250100.
 - 1.4.8 Review the Section on Motor Starters and Electrical Requirements for Mechanical Equipment.
 - 1.4.9 Where manufacturer's temperature controls are specified, they shall be in full compliance with NFPA 90-A including automatic smoke shut down provisions.
 - 1.4.10 For all belt driven equipment, provide final fan and motor sheaves as determined by the air balance contractor during project balancing phase. The mechanical contractor shall install any new sheaves and belts as required for balancing and smooth startup without any noticeable squealing.

PART 2 – EQUIPMENT:

2.1 Refer to drawings and schedules for requirements.

END OF SECTION.

DIVISION 23 - HVAC

SECTION 231100 - REGISTERS, GRILLES, DIFFUSERS & LOUVERS

PART 1 - REGISTERS, GRILLES AND DIFFUSERS:

1.1 GENERAL

1.1.1 Alternate R, G & D selections, other than manufacturers and models listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Metalaire, Anemostat, Price, Titus, Carnes, Nailor Industries and Tuttle & Bailey. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect. If Architect elects not to select color, all colors shall be white. Factory color samples shall be submitted with shop drawings.

1.1.2 Include with the shop drawings a room-by-room schedule indicating devices installed. Also note ceiling types and installations.

PART 2 – SELECTION:

2.1 Refer to drawings for schedule.

PART 3 – LOUVERS:

3.1 GENERAL

3.1.1 RELATED DOCUMENTS

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

3.1.2 SUMMARY

3.1.2.1 Section Includes:

3.1.2.2 Fixed, extruded-aluminum exterior wall louvers.

3.1.3 DEFINITIONS

3.1.3.1 Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

3.1.3.2 Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

3.1.3.3 Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

3.1.4 PERFORMANCE REQUIREMENTS

3.1.4.1 Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

3.1.4.1.1 Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.

3.1.4.2 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

3.1.4.2.1 Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

3.1.4.2.2 Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

3.1.5 SUBMITTALS

3.1.5.1 Provide separate and distinct submittals with separate transmittal forms for each of the buildings covered by these specifications. Combined submittals will be returned without review.

3.1.5.2 Product Data: For each type of product indicated.

3.1.5.2.1 For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

3.1.5.3 Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

3.1.5.4 Samples for Initial Selection: For units with factory-applied color finishes.

3.1.5.5 Samples for Verification: For each type of metal finish required.

3.1.5.6 Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

3.1.6 QUALITY ASSURANCE

3.1.6.1 Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

3.1.6.2 Welding: Qualify procedures and personnel according to the following:

3.1.6.2.1 AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

3.1.6.3 SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

3.1.7 PROJECT CONDITIONS

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

3.2 PRODUCTS

3.2.1 MATERIALS

3.2.1.1 Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

3.2.1.2 Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise

recommended by metal producer for required finish.

3.2.1.3 Fasteners: Use types and sizes to suit unit installation conditions.

3.2.1.3.1 For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3.2.1.3.2 For color-finished louvers, use fasteners with heads that match color of louvers.

3.2.1.4 Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

3.2.1.5 Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

3.2.2 FABRICATION, GENERAL

3.2.2.1 Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

3.2.2.2 Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

3.2.2.3 Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.

3.2.2.4 Maintain equal louver blade spacing to produce uniform appearance.

3.2.2.5 Fabricate frames, including custom sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

3.2.2.5.1 Frame Type: Channel.

3.2.2.6 Include supports, anchorages, and accessories required for complete assembly.

3.2.2.7 Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

3.2.2.7.1 Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.

3.2.2.8 Provide custom brake-formed loose sills, made of aluminum, 1/8-inch thick, as indicated on the Drawings for drainage to exterior and to prevent water penetrating to interior. Provide sills with same finish as louvers.

3.2.2.9 Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

3.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

3.3.1 Horizontal, Drainable-Blade Louver:

3.3.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Airolite Company, LLC (The).
- American Warming and Ventilating, Inc.; a Mestek company.
- Arrow United Industries.
- Construction Specialties, Inc.
- Greenheck Fan Corporation.
- Industrial Louvers, Inc.
- Nystrom Building Products/Airline Louvers.
- Reliable Products, Inc.
- Ruskin Company; Tomkins PLC.

3.3.1.2 Louver Depth: 6 inches.

3.3.1.3 Frame and Blade Nominal Thickness: Not less than 0.080 inch

3.3.1.4 Blade Angle: 45 degrees.

3.3.1.5 Louver Performance Ratings:

3.3.1.5.1 Free Area: Not less than 7.0 sq. ft. for 48-inch- wide by 48-inch- high louver.

3.3.1.5.2 Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area intake velocity.

3.3.1.5.3 Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 700 fpm.

3.3.1.6 AMCA Seal: Mark units with AMCA Certified Ratings Seal.

3.3.2 LOUVER SCREENS

3.3.2.1 General: Provide screen at each exterior louver.

3.3.2.1.1 Screen Location for Fixed Louvers: Interior face.

3.3.2.1.2 Screening Type: Bird screening.

3.3.2.2 Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

3.3.2.3 Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

3.3.2.3.1 Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

3.3.2.3.2 Finish: Mill finish.

3.3.2.3.3 Type: Rewirable frames with a driven spline or insert.

3.3.2.4 Louver Screening for Aluminum Louvers:

3.3.2.4.1 Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

3.3.3 FINISHES, GENERAL

3.3.3.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

3.3.4 ALUMINUM FINISHES

3.3.4.1 Finish louvers after assembly.

3.3.4.2 High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3.3.4.2.1 Color and Gloss: The Architect will select a PPG Duranar (Basis of Design) regular coating, custom color. Color will not be an exotic, XL or XL Exotic coating. Each building may have up to two colors for louvers,

3.4 EXECUTION

3.4.1 EXAMINATION

3.4.1.1 Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.4.1.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.4.2 PREPARATION

3.4.2.1 Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.4.3 INSTALLATION

3.4.3.1 Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

3.4.3.2 Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

3.4.3.3 Form closely fitted joints with exposed connections accurately located and secured.

3.4.3.4 Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

3.4.3.5 Protect aluminum surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.4.4 ADJUSTING AND CLEANING

3.4.4.1 Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

3.4.4.2 Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

3.4.4.3 Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

3.4.4.4 Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4.5 SELECTION

3.4.5.1 Refer to drawings for schedule

END OF SECTION.

DIVISION 23 - HVAC

SECTION 231200 - SHEET METAL AND FLEXIBLE DUCT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- 1.2 This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's Duct Manual and Sheet Metal Construction for Low Velocity Ventilating and Air Conditioning Systems. These references and plate numbers shall be used by the Engineer for required sheet metal thicknesses and final acceptance of methods of fabrication, hanging, accessories, etc. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.
- 1.3 All ductwork stored on site shall be maintained dry and clean. All stored ductwork shall be covered and ends shall be capped. After duct is installed open ends shall be capped with plastic. It is the responsibility of the Contractor to maintain a clean duct system. If system is soiled this Contractor shall be responsible for having ductwork cleaned by a NADCA Certified Contractor.
- 1.4 Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.
- 1.5 Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.

PART 2 - LOW VELOCITY DUCTWORK:

2.1 GENERAL (LOW VELOCITY)

- 2.1.1 Double turning vanes shall be installed in square turns and/or where indicated.
- 2.1.2 Provide a "high efficiency" type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements. Approved Manufacturers: Flexmaster, Dampers Express, and the Ductor Shop.
- 2.1.3 Cross-break all ducts where either cross sectional dimension is 18" or larger.
- 2.1.4 Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.
- 2.1.5 Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc.

- 2.1.6 The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.
- 2.1.7 Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from perlines or other weak structural members where no additional weight may be applied. If in doubt, consult the structural engineer.
- 2.1.8 Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.
- 2.1.9 All ductwork connections, fittings, joints, etc., shall be sealed. Seal with hardcast "Irongrip 601". Apply per manufacturer's recommendations. Acceptable manufacturers': Hardcast, Duro-Dyne and Galvagrip.
- 2.1.10 Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.
- 2.1.11 All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.
- 2.1.12 Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
- 2.1.13 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.
- 2.1.14 The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.
- 2.1.15 Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.
- 2.1.16 All fans and other vibrating equipment shall be suspended by independent vibration isolators.
- 2.2 MATERIALS (LOW VELOCITY)
- 2.2.1 Ductwork, plenums and other appurtenances shall be constructed of one of the following: (Except MRI Scan Rooms – only use aluminum in the MRI Scan Rooms)
- 2.2.1.1 Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating.
- 2.2.1.2 Aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14.

2.2.2 Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard or below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum.

<u>Round Diameter</u>	<u>Duct Gauge</u>	<u>Rectangular Width</u>	<u>Duct Gauge</u>
3-12 Inches	26 Ga.	3-12 inches	26 Ga.
12-18 Inches	24 Ga.	13-30 inches	24 Ga.
19-28 Inches	22 Ga.	31-54 inches	22 Ga.
29-36 Inches	20 Ga.	55-84 inches	20 Ga.
37-52 Inches	18 Ga.	85 inches and up	18 Ga.

2.2.3 Insulated Flexible Air Duct (Use Only Where Indicated)

2.2.3.1 Thermaflex G-KM or equal. Flexible air duct shall be one (1) inch thick fiberglass insulation with CPE liner permanently bonded to a coated spring steel wire helix supporting a fiberglass scrim and fiberglass insulating blanket. Flexible air duct shall be listed under UL Standard 181 as a Class I flexible air duct complying with NFPA 90A and 90B. Maximum flame spread = 25 and maximum smoke developed = 50. Minimum insulating value is R-4.2. Flexible duct shall be used only for GRD runouts and no section shall be more than five feet in length. Acceptable manufacturers: Thermaflex, Atco, Flex Master.

2.3 MISCELLANEOUS (LOW VELOCITY)

2.3.1 Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

2.3.2 Turning Vanes: Fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.

2.3.3 Access Doors in Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 2" thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils and downstream side of VAV boxes and CAV boxes.

2.3.4 Access Doors in Ceilings or Walls: Provide Kees D Panel, Cesco, Milcor or equal. 24"x24", 16 gauge galvanized steel door and frame with primer finish to accept specified finish, 3 screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

2.3.5 Volume Dampers (Rectangular): Leader MO3 or Empco, Air Balance, Louvers and Dampers, Cesco, Ruskin, Pottorff, Greenheck, rectangular volume dampers. Frames shall be 18 gauge galvanized steel. Blades shall be opposed blade 18 gauge galvanized steel with triple crimped blades on 6" centers. Linkage shall be concealed in jamb. Bearings shall be 1/2" nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

2.3.6 Volume Dampers (Round): Leader BR-4 or Empco, Air Balance, Louvers and Dampers, Cesco, Ruskin, Pottorff, Greenheck round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 22 gauge steel and 5" long. Damper blades shall be 20 gauge crimped galvanized steel. Axle shall be 3/8"x5" square plated steel. Bearing shall be 3/8" nylon. Provide with

Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation.
Provide permanent mark on dial regulator to mark air balance point.

END OF SECTION.

DIVISION 25 – BUILDING AUTOMATION SYSTEM

SECTION 250100 - ELECTRIC MOTORS, MOTOR STARTERS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 – GENERAL:

- 1.1 Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor .
- 1.2 There will be no change in the Contract Amount for discrepancies.
- 1.3 A final coordination meeting shall be held with the Architect, Owner, Engineer, Construction Manager, Mechanical Contractor, Electrical Contractor and their sub-contractors.

PART 2 - MOTORS:

- 2.1 The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
- 2.2 Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
- 2.3 Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
- 2.4 Temperature Rating: Rated for 40 deg. B environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class B Insulation).
- 2.5 Starting capability: frequency of starts as indicated by automatic control system and not less than 5 evenly time spaced starts per hour for manually controlled motors.
- 2.6 Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
- 2.7 Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
- 2.8 Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
- 2.9 Provide inverter rated motors where variable frequency drives are utilized. Motor shall be premium efficiency type with Class F insulation.
- 2.10 Bearings:
 - 2.10.1 Ball or roller bearings with inner and outer shaft seals;
 - 2.10.2 Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
 - 2.10.3 Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
- 2.11 Enclosure Type:
 - 2.11.1 Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;

- 2.11.2 Guarded drip-proof motors where exposed to contact by employees or building occupants;
- 2.11.3 Weather protected Type I for outdoor use, Type II where not housed;
- 2.12 Overload protection: Provide built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
- 2.13 Efficiency: Provide "Energy Efficient" motors with a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a minimum efficiency as listed below:
- | | | | |
|---------------|-------------|--------------|-------|
| 1 HP | 85.5% Eff'y | 10 HP | 91.7% |
| 1-1/2 to 2 HP | 86.5% | 15 HP | 93% |
| 3 HP | 89.5% | 20 HP | 93% |
| 5 HP | 89.5% | 25 HP and up | 94% |
| 7-1/2 HP | 91.0% | | |
- 2.14 Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - MOTOR STARTERS-GENERAL:

- 3.1 Provide motor starters where indicated on the mechanical equipment schedules or elsewhere in the contract documents.
- 3.2 Motor starters shall be NEMA style. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.
- 3.3 All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier should provide starters capable of limiting inrush currents. These shall be of the wye-delta, 2 speed-2 winding, or reduced voltage open-transition type, as required. Do not utilize closed transition starters unless specifically indicated.
- 3.4 Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.
- 3.4.1 Contacts shall be silver-alloy, double-break type except NEMA size 8 and 9 shall be single-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.
- 3.4.2 Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, except for size 8 and 9 which shall be hand wound. Provide coil clearing contact as required.
- 3.4.3 Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.
- 3.4.4 Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated on plans or schedules for automatic control.
- 3.4.5 Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily

replaceable, and resetable without opening enclosure, via a push button or similar means. Class 10 or Class 30 overloads may be used depending on type of motor duty encountered.

- 3.4.6 Provide at least one N.O. auxiliary contact (field-convertible to N.C. operation) with each starter. Refer to mechanical details or schedules for additional requirements, if any. All starters shall have space for two additional single-pole contacts.
- 3.4.7 All starters shall be thru-wiring type.
- 3.4.8 Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 7½ H.P. or larger.

PART 4 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT:

- 4.1 All mechanical equipment shall be provided for single point electrical connection unless specifically noted to the contrary.
- 4.2 The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, Part C, and other applicable sections of the N.E.C.
- 4.3 It shall be the Contractor's responsibility to assure that all mechanical equipment requiring electrical connections be provided with all required proper wiring, electrical protective devices, disconnecting means and electro-mechanical starting units to properly match the mechanical equipment requirement. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per code requirements.
- 4.4 Refrigeration condensing units with internal compressors shall be furnished with integral starter.
- 4.5 All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of this Contractor.
- 4.6 All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.
- 4.7 Observe the following standards for manufacture of equipment and in selection of components:
 - 4.7.1 Starters, control devices and assemblies: NEMA - (I.E.C. style not acceptable)
 - 4.7.2 Enclosures for electrical equipment: NEMA
 - 4.7.3 Enclosed switches: NEMA
 - 4.7.4 All electrical work, generally: NFPA 70
 - 4.7.5 All electrical work in industrial occupancies: J.I.C. standards
 - 4.7.6 All electrical components and materials: U.L. listing required.
- 4.8 Where scheduled on the drawings, provide disconnect switches and contactors. Disconnect switches to be fusible type or circuit breaker type.

PART 5 - REQUIREMENTS FOR MECHANICAL EQUIPMENT 3/4 H.P. OR LESS:

- 5.1 This section describes requirements for small mechanical equipment such as (but not limited to) package terminal heating/cooling units, water source heat pumps, VAV boxes, unit heaters, vertical and horizontal unit ventilators, exhaust fans, in-line fans, fan coil units, cabinet heaters, DDC temperature control panels, etc.
- 5.2 Small equipment with motor(s) of 3/4 H.P., single phase or less are generally not required to be furnished with starter(s), unless otherwise noted.
- 5.3 For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment.
- 5.4 Provide transformer within unit as required to provide low voltage A.C. for thermostat control.
- 5.5 Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder. See also Article 2.2, this Section.
- 5.6 Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction. Refer to mechanical equipment schedules for further information.

END OF SECTION.

DIVISION 25 – BUILDING AUTOMATION SYSTEM

SECTION 250400 – TEMPERATURE CONTROLS

PART 1 – GENERAL

- 1.1 The bid for Temperature Controls for this project shall include an allowance. Refer to bid documents for allowance. Schneider Electric shall furnish and install building controls and to fully integrate the new temperature controls system for this project into the existing TAC-VISTA server/front-end system in the Physical Plant. It is the responsibility of the contractor to coordinate with the temperature control contractor schedules and scope of work. The TCC shall be a subcontractor to the mechanical contractor.
- 1.2 The temperature controls for this project shall fully integrate to the existing the TAC-VISTA front end system in the Physical Plant. NKU has an on-going service contract with Schneider Electric. The building control system specified herein shall communicate with the TAC-VISTA system via LON protocol. See Section 6 for LON Protocol and LAN communication requirements. Interface and graphics generation on the university's DDC system server is included in this project and shall be consistent with the existing.
- 1.3 The direct digital control system specified for this project shall seamlessly interface to the existing TAC-VISTA Building Energy Management System Operator Workstations.
- 1.4 All application specific controllers on all network controllers shall be configurable, commissionable and downloadable through the Server or Supervisor Network Automation Engine IP connection.
- 1.5 All unitary and field controllers shall be commissioned, uploadable and downloadable from the university host network automation engine. LON object descriptions that are a jumble of letter/numbers are not acceptable.
- 1.6 The temperature control system shall be a web based system.
- 1.7 A pre-programming meeting shall be held with the TCC, Engineer, Owner and TAC-VISTA to discuss program variable names, room name scheme LON SNVT's and system structure.
- 1.8 All controllers, control interface hardware, services, installation, warranty, training, etc., shall be included as hereinafter specified.
- 1.9 The Temperature Control Contractor (TCC) shall provide all items, articles, materials, devices, operations or methods listed, mentioned or scheduled on the drawings including all labor, materials, equipment and incidentals necessary and required for their completion to provide a complete and operating temperature control system. This will include connecting to any mechanical equipment furnished with a control interface device and contacting the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished.
- 1.10 The system shall be a complete electronic DDC (Direct Digital Control) temperature control system utilizing "unitary" type controllers. Including such minor details not specifically mentioned or shown, as may be necessary for the complete operation of the system.
- 1.11 These apparatus' shall consist of, but not limited to, all necessary thermostats, sensing devices, valves, automatic dampers, damper motors, actuators, (except automatic dampers, valves, and damper motors furnished with HVAC equipment), and with the necessary accessories for the complete control of all equipment hereinafter specified.
- 1.12 Control sequences are specified at the end of this section. Provide all control equipment required to perform sequences described.

- 1.13 Provide all power wiring necessary for the operation of panels, etc., is to be included as work of this section. Refer to electrical specifications.
- 1.14 Acceptable Manufacturer's: TAC-VISTA by Schneider Electric Cincinnati Branch Contact: Ron Epp (513) 770-5716 or ron.epp@schneider-electric.com,
- 1.15 It will be the responsibility of TAC-VISTA to implement this project onto the university's server at the Physical Plant office. Any computer connected to the WAN, utilizing a web browser and having the proper password shall be able to communicate with the university's DDC system.

PART 2 – SUBMITTALS:

- 2.1 Shop drawing submittals shall include submittal data on every item of the temperature control system that is to be used. This is to include model and part numbers of all devices of the entire control system.
- 2.2 Submittals must include a complete points list of all necessary points and point types that will be provided by LON objects implemented into the universities TAC-VISTA system. (This will include any pseudo type points as well as all hard wired points). LON object descriptions are to include the equipment and type of point.
- 2.3 Submittals shall include a written operating sequence, unitary control wiring, building floor plans showing communicating cabling and labels, as well as logic flow diagrams.
- 2.4 Submittals shall include the agenda for approval by the engineer and owner of the specified training periods in one hour intervals. (see training section).
- 2.5 Submittals will include part numbers and manufacturer of all cabling that will be used. (indicate size and intended use).
- 2.6 Submittals shall include the manufactures recommended grounding procedure for all communication and device cabling.
- 2.7 The submittal process must be complete before any installation may begin.
- 2.8 Record Documents:
 - 2.8.1 Provide a complete set of control drawings with as-installed equipment and operating sequences on paper and in electronic format (Visio 2000 or AutoCAD v. 2000 or higher versions). "As-built" (i.e., as-installed and debugged and after system acceptance) documentation shall include the following as minimum:
 - All data specified in the shop drawings and submittals in their final "as-built" form.
 - Schematic outline of the overall control system for quick reference.
 - Adequate record of the work as installed, including exact location of control panels.
 - Electronic files shall include sequence of operation.
 - System hardware specification data, which provides a functional description of all hardware components.
 - System engineering information, which provides all of the information for the system set-up, definition and application.
 - System database information that provides the point names and application data programmed into the controllers.
 - All of the information, data, procedures and drawings shall be supplied in the form of manuals and electronic copies where applicable.
 - 2.8.2 Provide as-installed (after system acceptance) control logic diagrams showing all points (real and virtual).

- 2.8.3 DDC systems that use line-based programming must reference line code number with control logic diagrams and/or with sequence of operation text. Control Contractor shall discuss final format with owner.
- 2.8.4 For application oriented control units, provide sequence of operation text and answers to menu-driven configuration software.
- 2.8.5 Provide licensed electronic copies of all software provided by allowance. This includes, but is not limited to: project graphic images (editing/modifying/creating), project database, trouble-shooting and debugging programs, project-specific programming code and all other software required to operate and modify the programming code (including software at system level, primary control units, secondary control units, and all communication software). Any hardware devices (cables, protection devices) required to operate the software/hardware shall also be provided.
- 2.8.6 The Control Contractor shall document deviations from the shop drawing submittals. Documentation should include what equipment was changed and the reason for the change.
- 2.8.7 Provide copy of final test reports.
- 2.9 Operating and Maintenance Materials
- 2.9.1 Provide operation and maintenance data on all equipment requiring service or adjustment.
- 2.9.2 Operation and Maintenance Manuals: Provide three complete sets of manuals bound in loose-leaf binders. Final copies delivered shall include all modifications made during installation, checkout, and acceptance.
- 2.9.3 Manuals shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and have nearest service representatives for each item of equipment and each system.
- 2.9.4 Identify each manual's content on the cover. Place tab sheets at beginning of each chapter or section and at beginning of each appendix. Operation and Maintenance Manuals to include software manual, operations manual, maintenance manual, and acceptance manual.
- 2.9.4.1 Software Manual: The software manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution. Provide one software manual per Host Terminal. Hard copy or CD-ROM acceptable.
- 2.9.4.2 Operator's Manual: The operator's manual shall provide all procedures and instructions for operation of the system, including, but not limited to:
- General description including an overview of the system, its organization, the concepts of networking and central site/field hardware relationships.
 - DDC panels and peripherals.
 - System start-up and shutdown procedures.
 - Use of system, command, and applications software.
 - Alignment and calibration procedures.
 - Alarm presentation and reports
 - Recovery and restart procedures.
 - Report generation
 - System schematic graphics
 - Establish set-points and schedules
 - Download and upload information to or from field hardware
 - Generate, collect, and review trends
 - Back up system software and data files and

- Interface with third party software (e.g., Excel, Netscape).
- 2.9.4.3 Maintenance Manual: The maintenance manual shall include: Provide descriptions of maintenance for all equipment including:
- Inspection
 - Periodic preventive maintenance
 - Fault diagnosis
 - Repair or replacement of defective components
 - Emergency procedures for failure or fire
 - Disassembly and shutdown procedures
 - Maintenance instructions for each piece of equipment
 - Proper lubricants and lubricating instructions
 - Cleaning, replacement and/or adjustment schedule
- 2.9.4.4 Provide a Bill of Materials with each schematic drawing. List all devices/equipment and match to schematic and actual field labeling. Provide quantity, manufacturer, actual product ordering number, description, size, accuracy, operating ranges (voltage, temperature, pressure, etc.), input/output parameters, etc.
- 2.9.4.5 Field copies of wiring for Primary and Secondary Control Units. (Laminated and permanently affixed in or above controller).
- 2.9.4.6 For all equipment not manufactured by the Control Vendor, the Control Vendor shall provide an alphabetical list of system components with the name, address and 24-hour telephone number of the company responsible for servicing each item during the first two years of operation.

PART 3 - MAINTENANCE MANUAL/MAINTENANCE TOOLS:

- 3.1 Operating instructions, maintenance procedures, parts and repair manuals shall be supplied. Repair manuals shall include detailed instructions in the setup, calibration, repair and maintenance of all equipment furnished. Also supplied with these manuals will be a complete parts listing of all devices supplied which is to include part numbers and model numbers of all parts and component parts along with exploded views of devices. A hard copy of the entire database shall also be furnished.
- 3.2 Wiring and control diagrams shall be as installed. This means as-built drawings, not design (submittal) drawings.
- 3.3 All as built drawings (Wiring Diagrams, Flowcharts, and Floor plans) shall be supplied to the owner on AutoCad. (Compact Disc).
- 3.4 Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving. Software shall be "IBM compatible".

PART 4 - WARRANTY:

- 4.1 The temperature control system shall be free from defects in workmanship and material for a period of twelve months from substantial completion of project. If during this period from the signed (see below) date of final acceptance, any of the equipment furnished or installed by the TCC is proved to be defective (workmanship or material), it shall be replaced or repaired, free of charge.
- 4.2 The TCC shall include service required for start-up and calibration of all installed equipment for one season of heating and one season of cooling. A confirmation letter to the Engineer will be required for this work.

PART 5 – PRODUCTS:

5.1 General SI

5.1.1 TAC/Tour Andover Controls shall act as the University's Systems Integrator (SI) to provide several key aspects of the overall LonWorks®-based University Facility Management and Control System (FMCS) systems. These include but are not limited to:

- The TCP/IP level of the system architecture
- All computer servers and operator workstation.
- Data logging and reports of FMCS data
- Alarm presentation
- Time scheduling algorithms
- Graphical representation of data
- Web-based delivery of information
- Adjustment of application parameters (i.e., setpoints)
- Periodic adjustment of calibration offsets

5.1.2 In order to deliver these functions, TAC will provide one or more IP to LON routers and one or more area controllers (AC) depending on the number of devices to be installed by the building controls contractor under Div 25 specifications. The Systems Integrator (TAC) may combine the IP to LON router and area controller into a single physical component.

5.1.3 The area controller (AC) serves several key functions.

- It executes time schedules and broadcasts occupancy commands to the building controllers that it serves.
- It receives data from the building controllers and collects trends of the data.
- It receives data from the building controllers, applies alarm criteria and transmits alarms to the operator workstation alarm handling software provided by TAC.

5.2 Network Physical Interface With the Systems Integrator

5.2.1 For each IP to LON router and area controller provided by TAC, the building controls contractor shall provide a FTT-10 field bus or building LAN to which the building controllers will be connected. The number of building controllers that the building HVAC controls contractor shall be allowed to connect to each field bus is a function of the design of the field bus and the amount of data carried by the field bus. The average bandwidth utilization of any segment of the field bus shall not exceed 20% as measured by the LoyTech Network Analysis Tool over a 1-hour period during occupied mode.

5.2.2 TAC will provide a set of FTT-10 terminals adjacent to each area controller to which the building controls contractor shall attach their FTT-10 LAN.

5.2.3 The building HVAC controls contractor shall be responsible for the FTT-10 LAN terminators. The installation of network terminators shall conform to the guidelines published by Echelon. These guidelines are available on Echelon.com.

5.3 Application Development In Concert With the Systems Integrator (TAC/Tour Andover Controls)

5.3.1 Time Schedules

- Time schedules are the domain of the SI (TAC). Time schedules will be programmed in the area controller(s) (AC) by TAC and occupancy commands shall be bound from the area controller to the building level controllers by TAC where the applications require time based control.
- The SNVT type to be used for the commands shall be SNVT_occupancy.
- The building controls contractor shall inform the SI of all occupancy commands required, the corresponding time schedules, the controllers to which the occupancy commands shall be bound and the name of the receiving variable.

5.3.2 Other Direct or Supervisory Applications

- With the exception of time schedules or optimized start/stop algorithms, all applications shall be programmed within the building controllers. The building controls contractor should not expect the SI to provide any application support within the area controller to execute the required sequence of control.

5.4 Application Configuration Parameters

5.4.1 Programmable Devices

- Within an application program there are numerous parameters that must be adjusted during the commissioning of a system and/or be available for adjustment as requirements change. Some examples are:
 - Setpoints
 - Timing parameters, i.e., “Fan shall continue to operate until the electric heat has been off for 120 second.”
 - PID loop gain
 - PID loop integral time constant
 - PID loop derivative time constant
 - Two position control loop differential
 - Calibration offsets for analog inputs

5.4.2 For all applications in programmable building level controllers, configuration parameters shall be input network variables (nvis) to the building level controllers. As a result, these configuration parameters will be accessible to the SI for incorporation into the HMI database and can be adjusted by a systems operator without an application program download.

5.4.3 Application Specific Devices

5.4.3.1 There are two techniques for exposing configuration parameters currently in use by manufacturers of application specific devices.

- Configuration parameters of a specific SNVT type written to EEPROM.
- Configuration parameters that use the Standard Configuration Parameter Type (SCPT) format defined by Echelon.

5.4.4 The configuration parameters of a specific SNVT type have the same characteristics as a dynamic network variable and the Building Controls Contractor’s primary obligation is to submit a list of these configuration parameters to TAC. The submittal shall include the parameter name, purpose and SNVT type.

5.4.5 If the Building Controls Contractor chooses to use an application specific device that uses the SCPT concept, the Building Controls Contractor shall use LonMaker for Windows Integration Software Tool to construct a LonMaker database for the field bus where the application specific device is used. This database shall be provided to TAC.

5.5 DATA COORDINATION WITH TAC/Tour Andover Controls (SI)

5.5.1 Test Mode and Test Values

- This concept only applies to programmable devices.
- The Test Mode / Test Value concept applies to physical or external input points within an application. Using this concept, a system operator can place a physical input point into the test mode and assign a user defined value. When this is done, the electrical signal from the sensor shall be ignored by the application and the test value used in its place.
- The Building Controls Contractor shall provide two network variables for each physical input point associated with a programmable device. The first variable shall be used to place the physical input point into the test mode. The second variable shall be used to assign a test value.
- The Building Controls Contractor shall submit a list of the Test Mode / Test Value network variables to the SI. The list shall define the physical point and the variable names and SNVT types.

5.5.2 Manual Command and Manual Command Value

- This concept only applies to programmable devices.
- The Manual Command / Manual Command Value concept applies to physical or external output points within an application. Using this concept, a system operator can place a physical output point under manual control and assign a manual value or state. When this is done, the external output point ignores the command it routinely receives from the control logic and assumes the value or state of the manual command value.
- The Building Controls Contractor shall provide two network variables for each physical output point associated with a programmable device. The first variable shall be used to place the physical output point into the manual mode. The second variable shall be used to assign a manual command value or state.
- The Building Controls Contractor shall submit a list of the Manual Mode / Manual Command Value network variables to TAC. The list shall define the physical point and the variable names and SNVT types.

5.6 Alarm Data From the Building Controls to the Systems Integrator (TAC)

- 5.6.1 Alarm data can be either binary or analog. With binary alarm data, the variable has a value of either 0 or 1 and one of these states is defined as the alarm state. With analog alarm data, there is a corresponding threshold that creates an alarm condition (example, mixed air temperature falls below 42 F). A binary alarm can be created by applying the alarm threshold within the building level controllers.
- 5.6.2 Within an application, alarms can be either self correcting or latching. Self-correcting alarms will return to normal without operator intervention if the conditions within the application return to normal. Latching alarms will remain in the alarm state until an alarm reset parameter is toggled by the system operator.
- 5.6.3 For binary alarm conditions, the Building Controls Contractor shall expose an output network variable that defines the alarm. If the alarm is a latching alarm, an input network variable shall be established to allow TAC to affect an alarm reset from the HMI. If the binary alarm is created from analog data and an alarm threshold, the Building Controls Contractor shall expose an input network variable that defines the alarm threshold.
- 5.6.4 For analog non-latching alarms, the Building Controls Contractor shall expose the analog variable as an output network variable and define for TAC the alarm threshold. TAC will apply the alarm threshold within the area controller to create the alarm condition within the HMI.
- 5.6.5 For analog latching alarms, the Building Controls Contractor shall apply the alarm threshold within the application and create a binary alarm variable and expose it as an output network variable. The Building Controls Contractor shall also create and expose as an input network variable a reset parameter to be toggled by the system operator.

- 5.6.6 If timing parameters are required by the sequence of control with respect to the creation of alarms (“alarm condition must exist for 60 seconds before an alarm is transmitted”), and the alarm is created in a building level controller, the timing parameter must be exposed as an input network variable.
- 5.6.7 The Building Controls Contractor shall submit a list of the alarm value network variables to TAC. The list shall define the alarm names and SNVT types.
- 5.7 Calibration of Analog Inputs
- 5.7.1 This concept only applies to programmable devices.
- 5.7.2 As part of each application for each analog sensor input a calibrated value shall be established. The value read from the sensor shall be added to the calibration-offset parameter to create the calibrated value. An output network variable shall be established that transmits the calibrated value to the HMI.
- 5.7.3 The Building Controls Contractor shall submit a list of the calibration network variables to TAC. The list shall define the point names and SNVT types.
- 5.8 Dynamic Data Reporting
- 5.8.1 Data from both application specific and programmable devices shall be exposed as output network variables for access by TAC.
- 5.8.2 Output network variables from application specific devices are pre-established as part of the embedded application. There is no specific programming work to be done by the Building Controls Contractor. The Building Controls Contractor shall submit to TAC an electronic copy of the application documentation for each application specific node installed.
- 5.8.3 Output network variable from programmable devices shall be established as part of the applications. As a minimum, the following output network variables are required:
- Status of binary input devices
 - The calibrated value for analog input devices
 - Status of binary output commands
 - The value assigned by the application to analog outputs
 - All mode indicators (occupied, unoccupied, summer, winter etc.)
 - The output of all PID control objects
 - The output of all floating control loop objects or subroutines

PART 6 - SYSTEM ARCHITECTURE:

- 6.1 The network controller/supervisor links the primary, secondary, and application control units with the host computers for central reporting and system communication via the Wide Area Network (WAN).
- 6.2 The system shall be configured as a distributed processing network(s) capable of expansion as specified in this section.
- 6.3 The system architecture shall consist of a multi-level Wide Area Network (WAN), which supports Control Units, networked Operator Workstations, and LAN Interface Devices. The following indicates the functional description of the system structure.
- 6.3.1 Interbuilding LAN: Used for communication between Primary Controller LANs located in each building, and multiple networked Operator Workstations located in selected buildings. This WAN will consist of using the University’s Ethernet backbone with TCP/IP protocol. DDC workstations, network/controller supervisors, and the LAN Interface Device shall employ native TCP/IP protocol with the Ethernet 10BaseT (IEEE802.3)

physical layer standard for connection to Ethernet/ATM routers. DDC workstations or network/controller supervisor shall not require third party routers, gateways or translators for TCP/IP protocol. At a minimum, the Network/controller supervisors shall communicate via LON IP. The network/controller supervisor shall provide LON SNVT's via the university's Ethernet LAN for interface to the university's TAC-VISTA system.

- Control Contractor shall coordinate with university computer personnel on acceptable LAN protocol and interfacing.
- 6.3.2 Primary Controller LAN: Used to connect Primary Control Units (Primary Control Units-which generally control central plant equipment, terminal equipment, and air handlers) within a building.
- 6.4 Dynamic Data Access: Any data throughout any level of the network shall be available to and accessible by all other devices, Control Units, LAN Interface Devices, and Operator Workstations whether directly connected (via campus backbone) or connected remotely (using the university's WAN).
- 6.5 The communication speed between the Control Units, LAN interface devices, and MWS computer shall be sufficient to ensure fast system response time under the maximum future loading condition.
- 6.6 The Operator Workstations shall provide for overall system supervision, operator interface, management report generation, alarm annunciation and remote monitoring.
- 6.7 The primary and secondary control units shall monitor, control, and provide the field interface for all field points. Each Primary Control Unit or Secondary Control Unit shall be capable of performing DDC functions independent of other Primary Control Units or Secondary Control Units and operator interface devices (Stand-alone).
- 6.8 Interruptions or fault at any point in the primary LAN shall not interrupt communications between other nodes on the network.
- 6.9 All line drivers, signal boosters, repeaters, and signal conditioners etc. shall be provided as necessary for proper data communication.

PART 7 - NETWORK CONTROLLER/SUPERVISOR:

- 7.1 The Network Controller shall be a fully user-programmable supervisory controller. The Network Controller shall monitor and communicate the network of distributed primary, secondary, application-specific control units, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers/Supervisors.
- 7.2 Controllers shall be microprocessor-based with a maximum program scan rate of one (1) second. They shall be multi-tasking, multi-user, and real-time digital control processors. Controller size and capability shall be sufficient to fully meet the requirements of this Specification.
- 7.3 Network Controller/Supervisor shall support/communicate with a minimum of 100 primary/secondary control units with no more than 90% of maximum capability used. Memory size shall have at least 20% of availability free for future use.
- 7.4 Each controller shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control units. In addition, if memory for historical data trending is not on primary and/or secondary control units, then sufficient memory is required on the network controller to capture and record historical trending data. The network controller / supervisor shall issue all summer/winter commands, clock or other shared commands to all unitary and primary controllers within the building network. If for any reason communications between the unitary(s) and the network controller / supervisor is lost, the unitary(s) shall operate in a stand alone manner (in day operation) until communications is restored. It shall also operate in the "summer" or "winter" mode as last commanded.

- 7.5 Network Controller/Supervisor shall be capable of interacting host workstations.
- 7.6 The Network Controller/Supervisor shall have an integrated real-time clock.
- 7.7 Error detection, correction, and re-transmission to guarantee data integrity.
- 7.8 Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
- 7.9 In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
- 7.10 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.
- 7.11 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
- 7.12 Should a primary/secondary controller memory be lost for any reason, the Network Controller/Supervisor shall be able to reload the program with back-ups provided by TCC.
- 7.13 The network controller / supervisor shall have the capability of being remotely monitored over telephone modem via V90 modem. Additional capabilities shall include automatically dialing out alarms, gathering alarms, reports and logs, programming and downloading database.
- 7.14 The network controller / supervisor shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:
 - 7.14.1 Assume a predetermined failure mode.
 - 7.14.2 Emit an alarm.
 - 7.14.3 Display card failure identification.
- 7.15 Install the network controller / supervisor in a surface mounted panel, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. All control panels must be painted the same color and identified. The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.
- 7.16 The network controller shall support both LonWorks enabled devices using the Free Topology Transceiver FTT10.
 - 7.16.1 All LonWorks controls devices shall be LonMark certified.

PART 8 - SYSTEM SOFTWARE:

- 8.1 System software will be the latest version available with upgrades provided for full warranty period, and shall be fully licensed to the owner for all Host computer(s) and laptop(s).
- 8.2 System software shall, at a minimum, provide:
- 8.3 Monitor and supervise all control points.

- 8.3.1 Add new points and edit system database.
- 8.3.2 Change control setpoints, timing parameters and loop tuning of PID coefficients in all control loops in all control units.
- 8.3.3 Enter programmed start/stop schedules.
- 8.3.4 View alarm and messages.
- 8.3.5 Modify existing control logic (or sequence of operation) in all control units.
- 8.3.6 Upload/Download programs, databases, control parameters, etc.
- 8.4 Sequence of Operation Programming "Methodology"
 - 8.4.1 The application software shall be user programmable. Application programming shall be provided by the following conventions:
 - Line type programming that uses text programming in a language similar to BASIC or FORTRAN.
 - Graphical Block Programming: The method of programming shall be by manipulation of graphic icon "blocks." Each block represents a subroutine containing the programming necessary to execute the function of the device that the block represents.
- 8.5 Unitary Control Unit Database Archiving
 - 8.5.1 The host software shall provide capability to upload sequence of operation, database, and other control parameters from each controller.
 - 8.5.2 Uploaded programs shall be retained on hard disk for system backup.
 - 8.5.3 Programs may be modified using Editor functions, and downloaded to individual controllers as desired. Downloading of databases shall not interrupt other multi-tasked functions that are ongoing.
- 8.6 Operator Interface Graphic Software
 - 8.6.1 All graphic software shall be in the html web browser format or pinpoint graphics and support multiple simultaneous screens to be opened and resizable in a "Windows" type environment. All functions, except text entry, shall be executable with a mouse.
 - 8.6.2 Graphic software shall provide for multitasking such that third party programs can be used while the Operator Workstation Software is on-line. Provide the ability to alarm graphically even when operator is in another software package.
 - 8.6.3 The software shall allow for Owner to create user defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics.
 - 8.6.4 The contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, heat pumps etc.), mechanical system components (e.g., pumps, cooling towers, boilers, etc.), complete mechanical systems and electrical symbols.
 - 8.6.5 The graphic development package shall use a mouse or similar pointing device to allow the user to perform the following:
 - Define symbols

- Position items on graphic screens
- Attach physical or virtual points to a graphic
- Define background screens
- Define connecting lines and curves
- Locate, orient and size descriptive text
- Define and display colors for all elements
- Establish correlation between symbols or text and associated system points or other displays.
- Create hot spots or link triggers to other graphic displays or other functions in the software.

PART 9 - EXECUTION - SYSTEM SETUP:

- 9.1 This section further defines the responsibilities of the installer and building level and the Metasys programmer.
- 9.2 The following features shall be incorporated into the final delivered product.
- 9.3 Schedules
- 9.3.1 Schedule will be installed using time parameters provided by owner or obtained on drawings.
- 9.3.2 Stand-by mode shall be installed with Owner's approval.
- 9.3.3 Scheduling editor shall be provided at each Host computer.
- 9.3.4 Scheduling editor shall be capable of, at a minimum:
- Easy method for selecting time periods and days for occupied and unoccupied periods for each object (e.g., Unit Heaters).
 - Holiday and breaks shall be shown clearly on the calendar.
 - Weekly Schedules: The weekly schedules screen shall display a full week with holidays and special days included.
 - Provide a method for allowing several related heat pump systems or other equipment to follow a similar schedule.
 - It shall be possible to easily and directly copy the schedule for any scheduled event to any other scheduled event without reentering all times.
 - Each schedule shall accept a unique descriptor of up to at least 20 characters to identify the schedule on screen.
 - Annual Schedules: An annual schedule calendar mechanism shall be provided to schedule Holidays, time changes and Special school days a minimum of one year in advance. A full screen editor in calendar format shall be provided to allow speedy selection and review of holidays and special days.
 - Dated schedules shall be self-managing and automatically deleted after execution.
 - Schedule Override:
 - It shall be possible to easily override, to the on or off condition, any programmed scheduled event at any operator workstation. There shall be no limit to the number of schedules that can be overridden at any one time. Conditions shall revert to schedule when override period ends.
- 9.4 Graphic Screens
- 9.4.1 Color graphic Operator Interface:
- Graphics must coincide with NKU Standards as follows:
 - Start/Stop and Status points must indicate a graphical and color change in state, (green to black) or similar presentation using the same color scheme.

- All applicable control points must have “Forced by Operator” or “Manual Mode” properties that are clearly displayed on individual graphic pages for each point accessible from the graphic page. This is displayed by a “M” in the data field.
- All alarms must be displayed in the alarm queue and also on the coinciding graphic page with a red flashing alarm indication in the data field and/or similar graphic presentation.
- All data fields must indicate a unit of measure; DegF, %, ppm, etc.
- Each graphic page must be individualized; a “Master” may not be used as a template for similar zones/controllers so that zone or area specific instructions/notes can be added to each graphic.
- The graphical programming software shall allow for interactive mouse-driven placement of block icons on the graphic screen and connection of block inputs to block outputs by means of drawing lines to form a graphic logic diagram.
- The user shall not have to manually input text to assign block input/output interconnections. Blocks shall allow entry of adjustable settings and parameters via pop-up windows.
- The clarity of sequence shall be such that the user has the ability to verify that the system programming meets the specs without having to learn or interpret a manufacturers unique programming language.
- Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs.
- Logic diagrams shall be viewable either off-line, or on-line with real-time output values.
- Provide a means for testing and/or debugging the control programs off-line (not communicating with control units) using operator entered values for physical inputs and time.
- Provide a means for testing and/or debugging the control programs on-line (communicating with control units), showing actual physical inputs and all block outputs in real time.
- Provide dual or multiple function windowing to allow user to view two or more screen and toggle between simultaneous operations.
- Update all point values a minimum of every 10 seconds.
- Each colorgraphic terminal shall be driven by software allowing the operator to access all system information via a system penetration method.
- System penetration shall allow the operator to begin at an entire site plan colorgraphic display and progressively select portions of the site plan to be chosen for closer inspection or selection of a more detailed colorgraphic display of a desired system without being required to enter any commands via the keyboard. Specifically,
 - Graphics display screens shall include a system level graphic of either a map of facilities or an elevation of the building, a graphic of each building floor plan and graphics for each operating system or unit within each building. Entry to the zone and equipment level interface graphics shall be through area maps and/or floor plans to facilitate user orientation. Using a mouse or other pointer device shall access graphics. The system shall provide a visual indication of which building, floor and zone the user is accessing at any time.
- Graphics shall be provided for all mechanical equipment and devices controlled by the DDC system. These graphics shall include:
 - Flow diagram or graphic diagram showing all devices (e.g., valves, dampers, sensors, fans, pumps, boilers, etc.)
 - Current status of all I/O points being controlled and applicable to each piece of equipment.
 - Operating mode (occupied, unoccupied, overridden, etc.)
 - Time and date
 - Percentage valve/damper open or closed (include “open” or “closed” on the screen.
 - Analog readouts in mA or VDC (for commissioning and can be located on a separate screen if needed to reduce screen clutter)
 - All analog and digital input and output points settable from the screen.
 - Place all values in appropriate engineering units and in appropriate locations on the graphic representation.
 - Electrical Schematics associated with all mechanical equipment and devices controlled by the DDC (These schematics should also be provided with as-builts).
- All color graphic screens shall be standardized for similar mechanical equipment and control devices. The type of points displayed will be the same for similar colorgraphic screens.

9.4.2 Other colorgraphic screens shall include:

- Temperature setpoints for all rooms/zones.
- All adjustable points

9.4.3 Accessible System Information:

- Available for display or modification in any specific colorgraphic display shall include, but not be limited to:
 - Real-time value display of any connected point in the system
 - Alarm status condition of any desired system alarm point (change in color when out of range).
 - Any software parameter such as setpoints for control sequences, minimum position adjustments.

9.4.4 Centralized Scheduling and Modification:

- The colorgraphic terminal shall support operator access to the Scheduling Screens that allow the operator to review and modify any or all schedules as desired. The centralized Scheduling function shall allow modification of equipment schedules, modification of facility holiday schedules, and when desired allow assignment of temporary schedules for designated portions of the facility or specific equipment.

9.5 Labeling and Identification

9.5.1 All devices relating to the work or systems included herein, including controllers, valves, motors, relays, etc., shall be identified with a unique identification number or name on the submitted engineering drawings.

9.5.2 Tagging/labeling shall be computer generated or wire markers, input/output wiring, at both ends. These labels will correspond to the identification numbers or names on the AS BUILTS.

- Cable and wiring not specifically associated with an input or output shall be labeled with a number and a function description such as: 120 VAC, Panel #, ect. (e.g., actuator/unit ventilator ect., power supply).
- Category 5 Ethernet cabling and communication cabling shall be easily identified as a unique color and labeled at each end throughout the building.

9.6 Programming Guidelines

9.6.1 All control loops will be standardized throughout the programming code.

9.6.2 All adjustable set-points shall be developed as software points stored at memory locations so that setpoints can be changed by recommending the data stored at the memory location rather than by entering the program and changing parameters and lines in program code.

9.6.3 Control sequences that use outdoor air conditions to trigger certain specific operating modes shall use data generated by one outdoor air temperature sensor. In other words, the data from one sensor shall be shared by the entire system.

9.7 System Commissioning and Training

9.7.1 During all pre-installation meetings and construction meetings with Mechanical Contractor, Engineers, and/or Owners, the Control Contractor attending the meetings must be the application engineer or programmers that are/will design and program the DDC system.

9.8 Demonstration Commissioning

- 9.8.1 This portion of commissioning must be performed with a representative of the NKU Physical Plant staff and the Engineer present.
- 9.8.2 Work and/or systems installed under this section shall be fully functioning prior to Demonstration, Acceptance Period and Contract Close Out. Control Contractor shall start, test, adjust, and calibrate all work and/or systems.
- 9.8.3 Software shall be fully configured to view project specific database and shall include trend logs, specified graphic screens, and reports.
- 9.8.4 As problems are found, a log shall be completed showing the date, technicians and Owners initials, and any corrective action taken or needed.
- 9.8.5 Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Control Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.
- 9.8.6 All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of this document.

PART 10 – CABLING:

- 10.1 A complete cabling system shall be furnished and installed, which shall adhere to the highest workmanlike standard of quality and appearance. Lines shall be installed square with building lines.
- 10.2 All cabling shall be concealed in walls and above ceilings where ceilings exists. Cabling may be ran above lay-in ceilings without being in conduit. Support from structure. Where cabling is installed in storage rooms, or above non-lay-in ceilings, all wiring shall be installed in conduit.
- 10.3 Install conduit in wall from wall thermostats to above ceiling for cabling.
- 10.4 Acceptable manufacturers are Belden, West Penn or Alpha. Any cable other than the above must have prior approval.
- 10.5 All unitary to unitary zone communication cabling shall be a minimum of 18 AWG minimum. All other sizing of cabling shall be according to manufacturer's recommendation.
- 10.6 Furnish a floor plan of the building indicating communication cable labeling and routing as well as addresses and branch wiring from the unitary devices. All cabling shall be labeled on both ends. The type, size and label of all cabling shall be indicated on submittal floor plan drawings.
- 10.7 Wall space temperature sensor cabling (from the sensor to the unitary controller) shall have a minimum of four (4) conductors.
- 10.8 All cabling shall be stranded. "NO" solid conductors will be accepted. All cabling shall be 100% shielded with appropriate drain wire and insulation.
- 10.9 All cable connections shall be continuous run (including shield) whenever possible. Any junctions must be made in a metal enclosure, connections must be soldered, taped and the metal enclosure must be mechanically attached to the nearest ground. No wire nuts or crimped connections will be accepted. Note location of junction boxes on the as built floor plans.
- 10.10 All shields must be terminated as per manufacturer's recommendation. Shield termination requirements by the manufacturer must be provided with submittals.

PART 11 - ELECTRICAL WIRING SYSTEMS:

- 11.1 Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.
- 11.2 Any power for controls shall be fed from circuits in electrical panels shall not be taken from receptacles, lighting, or equipment circuits. Unitary control power may be taken from the equipment served. If power is taken from the equipment served, the power may not be interrupted to the electronics if the terminal unit is off for any reason. This contractor is responsible for the power source to the unitary controllers and all other control power requirements.
- 11.3 All control circuits within the electrical panels shall be marked to indicate equipment served.
- 11.4 The TCC shall do all temperature control interlock wiring. This is to include zone controls, exhaust fans, dampers, etc.
- 11.5 The TCC shall be responsible for any power required for the unitary controls or control panels. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.

PART 12 - TEMPERATURE SENSORS AND MISCELLANEOUS DEVICES:

- 12.1 **SENSOR RESOLUTION:** All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensor stability shall be .24 degrees over a year period. Space sensors must be tested and accurate to within .75 degrees F. Outside air, water and duct sensors must be tested and accurate to within 2.0 degrees F.
- 12.2 **SPACE SENSORS AND THERMOSTATS:**
 - 12.2.1 Refer to the drawings for proper type and location.
 - 12.2.2 Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point for supervised areas.
 - 12.2.3 Unsupervised areas shall have non-adjustable set-point.
 - 12.2.4 Generally, thermostats/sensors shall be installed 5'-0" above the finished floor.
 - 12.2.5 Where thermostats/sensors are to be mounted next to a light switch, install at the same height as the light switch.
 - 12.2.6 If there is a question consult engineer prior to rough-in.
 - 12.2.7 **SPACE SENSORS:** Thermostats shall be provided with a "warmer/cooler" dial.
 - 12.2.8 **DISCHARGE AIR AND DUCT ROOM RETURN AIR SENSORS:** Shall be rigid insertion type. In all applications, care must be taken to insure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.
 - 12.2.9 **RELAYS:** Relays for starting and stopping fractional horsepower motors shall be rated as follows:
 - 12.2.10 1/4 horsepower motors or less use 15 ampere rated relays,
 - 12.2.11 1/3 horsepower motors use 20 ampere rated relays,

- 12.2.12 1/2 horsepower motors use 30 ampere rated relays,
- 12.2.13 Relays used for pilot duty service shall be rated at a minimum of 10 amperes.
- 12.2.14 Provide auxiliary pilot duty relays on motor starters as required for control function.
- 12.2.15 Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.
- 12.3 CURRENT SENSING DEVICES: Veris Industries model Hx08 Series and H701 or equal. All current sensors shall be capable of alarming to the BAS for belt losses, pump coupling shear or other mechanical failure on loads.
- 12.4 POTABLE WATER FLOW METER: Onicon Model F-1330/F-1130 series dual turbine insertion flow meter suitable for potable water applications. 50:1 turn down with 2% accuracy with 0.4 to 20 fps range. Install flow meter with sufficient pipe diameters as recommended by manufacturer. Provide factory authorized start-up verification of operation and calibration. Provide with remote display where indicated.

PART 13 -DAMPERS AND ACTUATORS:

- 13.1 Dampers for various units requiring field mounting shall be tight closing, "ultra low leakage", opposed blade with side and edge seals. They shall be sized and furnished under this section. Installation of dampers shall be by the sheet metal contractor, coordinated by the TCC. Frames shall be no less than 16 gauge galvanized steel and furnished with mounting holes for duct mounting. Damper blades shall be no less than 14 gauge galvanized steel with maximum blade width of 8 inches. Blades shall be secured to 1/2 inch zinc plated axles and hardware with nylon bearings. Provide thrust bearings at the end of each blade. All dampers shall have end switches to positively prove damper position. No Exceptions!
- 13.2 All damper and valve actuators shall be fail safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They shall return to the normally open position upon a loss of power.
- 13.3 "ALL" Actuators shall be of the same manufacturer and have internal feedback circuitry to provide a positive action to insure proper positioning of the damper or valve through the entire sequence. Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application.
- 13.4 Actuators may be factory installed. If not factory installed they shall be installed as per instructions by the terminal equipment manufacturer.
- 13.5 Locations mounted above ceiling shall be marked on ceiling grid. Access panels shall be provide in area wih hard ceilings.
- 13.6 Install damper motors on the outside of the duct in warm areas where possible, not in air stream or locations exposed to outdoor conditions.

PART 14 – EQUIPMENT:

- 14.1 UNITARY and PRIMARY CONTROLLERS: Controllers utilized in the network must have full stand alone capability required to meet the sequence of operations. Any re-programming of the electronics shall be performed on location using a portable personal computer with appropriate software or through the Network Controller / Supervisor. The entire unitary database shall have the capability of being backed up and or downloaded locally and via modem if required. All primary controllers shall have built in displays for local

access and adjustment of control parameters.

- 14.2 Controller used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F. All controllers shall have an RJ-11 or similar type connection for monitoring or programming access by room or local equipment level with access to any unitary within the network without modification.
- 14.3 NETWORK CONTROL ENGINE: The Network Control Engine shall have an integral keypad and display and issue, summer/winter commands, or other shared commands to all unitary controllers within the building network. If for any reason communications between the unitary(s) and the global controller is lost, the unitary(s) shall operate in a stand alone manner (in day operation) until communications is restored. It shall also operate in the "summer" or "winter" mode as last commanded.
- 14.3.1 The Network Control Engine shall have **UPS power supply** to allow a minimum of three days of operation. The Network Control Engine shall be composed of one or more independent, stand-alone, microprocessor to manage the global strategies described in Application software section. The Network Control Engine shall have ample memory to support its operating system, database and programming requirements. The operating system of the global controller shall manage the input and output communications signals to allow distributed unitary controllers to share real and virtual point information and allow central monitoring and alarms. The database and custom programming routines of the Network Control Engine shall be editable from a single operator station or laptop computer.
- 14.3.2 The Network Control Engine shall have the capability of being remotely monitored over IP address. Additional capabilities shall include automatically emailing, texting out alarms, gathering alarms, reports and logs, programming and downloading database.
- 14.3.3 The Network Control Engine shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:
- Assume a predetermined failure mode.
 - Emit an alarm.
 - Display card failure identification.
- 14.3.4 Install the Network Control Engine in a surface mounted panel, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. All control panels must be painted the same color and identified. The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.
- 14.4 PANELS: All panels must be surface mounted type, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. (All temperature control panels are to be keyed the same.) All control panels must be painted the same color and identified. (premiered panels will not be acceptable) The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.

PART 15 - SEQUENCE OF OPERATION –OFFICE:

- 15.1 A wall mounted thermostat with warmer-cooler adjust shall control electric unit heater to maintain a minimum heating setpoint of 68 deg F (adj.) when the building is schedule occupied and 40 deg F (adj.) when the building is schedule unoccupied.
- 15.2 The sidewall motorized dampers and ceiling mounted exhaust fans EF-1 shall be used for cooling. When the space temperature exceeds 80 deg F (adj.) the motorized damper shall open and the associated exhaust fan shall start.

PART 16 - SEQUENCE OF OPERATION – RESTROOM HVAC:

- 16.1 A cabinet mounted thermostat shall control electric cabinet heater to maintain a minimum heating setpoint of 65

deg F (adj.) when the building is schedule occupied and 40 deg F (adj.) when the building is schedule unoccupied.

- 16.2 The sidewall motorized dampers and ceiling mounted exhaust fans EF-3 and EF-4 shall be interlocked with the dual contact ceiling mounted occupancy sensor. When motion is detected the motorized damper shall open and the associated exhaust fan shall start.
- 16.3 The sidewall motorized dampers and ceiling mounted exhaust fans EF-3 and EF-4 shall be used for restroom cooling. When the space temperature exceeds 80 deg F (adj.) when the building is scheduled occupied the motorized damper shall open and the associated exhaust fan shall start.

PART 17 - SEQUENCE OF OPERATION – STORAGE HVAC:

- 17.1 A wall mounted thermostat shall control electric unit heater to maintain a minimum heating setpoint of 65 deg F (adj.) when the building is schedule occupied and 40 deg F (adj.) when the building is schedule unoccupied.
- 17.2 The sidewall motorized dampers and ceiling mounted exhaust fans EF-2 shall be used for storage cooling. When the space temperature exceeds 80 deg F (adj.) the motorized damper shall open and the associated exhaust fan shall start.

PART 18 – DOMESTIC WATER MONITORING:

- 18.1 The DDC System shall monitor domestic water consumption.
- 18.2 Install flow meter in cold water supply to the building.

PART 19 - THE ELECTRICAL SWITCHGEAR/POWER INTERFACE:

- 19.1 The electrical switchgear shall be monitored through the DDC system via Mod Bus Connection. Coordinate the interface with the switchgear manufacturer. Control wiring to the power meter to be provided by the TCC. The following points shall be monitored:
- 19.2 There are a total of 1 power meters to monitor.

Point Name	Hardware Points				Software Points					Show On Graphic
	AI	AO	BI	BO	AV	BV	Sched	Trend	Alarm	
Current Phase A					×			×		×
Current Phase B					×			×		×
Current Phase C					×			×		×
Current Neutral					×			×		×
Voltage A-B					×			×		×
Voltage B-C					×			×		×
Voltage C-A					×			×		×
Voltage A-N					×			×		×
Voltage B-N					×			×		×
Voltage C-N					×			×		×
Real Power - kW					×			×		×
Apparent Power - kVA					×			×		×
Power Factor					×			×		×

Point Name	Hardware Points				Software Points					Show On Graphic
	AI	AO	BI	BO	AV	BV	Sched	Trend	Alarm	
Frequency					×			×		×
Real Energy - kWh					×			×		×

PART 20 – SEWAGE EJECTOR PUMP:

20.1 The DDC shall monitor the high limit for the sewage ejector pump and alarm to the BAS

PART 21 – PLUMBING CHASE TEMPERATURE MONITORING:

21.1 The DDC system shall monitor plumbing chase temperature provide a low temperature alarm. Coordinate temperature setpoint with owner. Architect to provide access panel to temperature sensor.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260500 - GENERAL PROVISIONS - ELECTRICAL

PART 1 – GENERAL:

- 1.1 The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- 1.2 Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.
- 1.3 The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.
- 1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.
- 1.5 It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.
- 1.6 This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.
- 1.7 It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.
- 1.8 In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.
- 1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable

utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

1.10 Definitions:

- 1.10.1 Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.
- 1.10.2 Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.
- 1.10.3 Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.
- 1.10.4 Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.
- 1.10.5 Architect - The Architect of Record for the project, if any.
- 1.10.6 Furnish - Deliver to the site in good condition.
- 1.10.7 Provide - Furnish and install in complete working order.
- 1.10.8 Install - Install equipment furnished by others in complete working order.
- 1.10.9 Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.
- 1.10.10 Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

PART 2 – INTENT:

- 2.1 It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use.
- 2.2 Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

PART 3 - ELECTRICAL DRAWINGS AND SPECIFICATIONS:

- 3.1 The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.

- 3.2 The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.
- 3.3 The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- 3.4 This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- 3.5 The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.
- 3.6 Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
- 3.7 Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- 3.8 The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.
- 3.9 The Electrical Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.
- 3.10 Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- 3.11 Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

PART 4 - EXAMINATION OF SITE AND CONDITIONS:

- 4.1 Each Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and

location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.

- 4.2 Each Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

PART 5 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

- 5.1 When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.
- 5.2 References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgement of the Engineer is equivalent to that specified, provided the provisions of paragraph (5.1) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.
- 5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.
- 5.4 Each Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

PART 6 - SUPERVISION OF WORK:

- 6.1 Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

PART 7 - CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.:

- 7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and

- governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work..
- 7.2 Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.
- 7.3 The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.
- 7.4 All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
- 7.5 All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.
- 7.6 All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
- 7.7 The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.
- 7.8 Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

PART 8 - COST BREAKDOWNS:

- 8.1 Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted.

PART 9 - GUARANTEES AND WARRANTIES:

- 9.1 **(FOR ALL KDE PROJECTS):** The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion.
- 9.2 Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of

final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

OR

(FOR ALL PROJECTS EXCEPT KDE): The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within one year from final acceptance of the work by the Engineer. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

PART 10 - INSPECTION, APPROVALS AND TESTS:

- 10.1 *Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.
- 10.2 *Electrical inspection will be performed throughout the course of construction by a certified electrical inspector from the Department of Housing, Buildings and Construction. When the project is complete and in compliance with applicable codes, rules and regulations, the inspector shall issue a certificate of compliance to the Owner.
- 10.3 *The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the Commonwealth of Kentucky. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.
- (*) **PLEASE CHOOSE THE ONE APPROPRIATE FOR YOUR PROJECT.**
- 10.4 The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- 10.5 Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.
- 10.6 Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

- 10.7 Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.
- 10.8 The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.

PART 11 - CHANGES IN ELECTRICAL WORK:

- 11.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 12 - CLAIMS FOR EXTRA COST:

- 12.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 13 - SURVEYS, MEASUREMENTS AND GRADES:

- 13.1 The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.
- 13.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- 13.3 Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

PART 14 - TEMPORARY USE OF EQUIPMENT:

- 14.1 The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.
- 14.2 Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 15 - TEMPORARY SERVICES:

- 15.1 The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

PART 16 - RECORD DRAWINGS:

- 16.1 The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer at the completion of the work.

PART 17 - MATERIALS AND WORKMANSHIP:

- 17.1 All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
- 17.2 All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.
- 17.3 All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.
- 17.4 Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.
- 17.5 All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.
- 17.6 All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

PART 18 - QUALIFICATIONS OF WORKMEN:

- 18.1 All electrical contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supercede this requirement.
- 18.2 All subcontractors bidding the electrical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- 18.3 All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

- 18.4 All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.
- 18.5 Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

PART 19 - CONDUCT OF WORKMEN:

- 19.1 The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

PART 20 - COOPERATION AND COORDINATION BETWEEN TRADES:

- 20.1 The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.
- 20.2 Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

PART 21 - PROTECTION OF EQUIPMENT:

- 21.1 The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

PART 22 - CONCRETE WORK:

- 22.1 The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.
- 22.2 All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than 18" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.

- 22.3 Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.
- 22.4 In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads 18" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.
- 22.5 Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, trowelled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

PART 23 - RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.:

- 23.1 The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable.

PART 24 - MAINTENANCE OF EXISTING UTILITIES AND LINES:

- 24.1 The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.
- 24.2 Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.
- 24.3 If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.
- 24.4 Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
- 24.5 The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
- 24.6 Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.
- 24.7 Protect all new or existing lines from damage by traffic, etc. during construction.
- 24.8 Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

PART 25 - SMOKE AND FIRE PROOFING:

- 25.1 The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

PART 26 - QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION:

- 26.1 All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.
- 26.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.
- 26.3 The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

PART 27 - FINAL CONNECTIONS TO EQUIPMENT:

- 27.1 The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturer's representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

PART 28 - WELDING:

- 28.1 The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

PART 29 – ACCESSIBILITY:

- 29.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
- 29.2 The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
- 29.3 Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.
- 29.4 Access Doors; in Ceilings or Walls:
- 29.4.1 In mechanical, electrical, or service spaces:
- 29.4.1.1 14 gauge aluminum brushed satin finish, 1" border.
- 29.4.2 In finished areas:
- 29.4.2.1 14 gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.
- 29.4.3 In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

PART 30 - ELECTRICAL CONNECTIONS:

- 30.1 The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Mechanical Sections of Specifications, shop drawings and equipment schedules for additional information.
- 30.2 All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Electrical Specifications regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.
- 30.3 Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

PART 31 – MOTORS:

- 31.1 Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.
- 31.2 The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Mechanical Sections of Specifications for further requirements and scheduled sizes.

PART 32 - CUTTING AND PATCHING:

- 32.1 Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.
- 32.2 No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

PART 33 - SLEEVES AND PLATES:

- 33.1 Each Contractor shall provide and locate all sleeves and inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.
- 33.2 Sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running embedded in concrete or insulating concrete slabs on grade, unless otherwise noted.
- 33.3 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead, mechanical waterstop or other approved material and made completely water tight by a method approved by the Engineer and/or Architect.
- 33.4 Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
- 33.4.1 Terminate sleeves flush with walls, partitions and ceiling.
- 33.4.2 In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.
- 33.4.3 In all areas where pipes are exposed, extend sleeves ¼ inch above finished floor, except in rooms having floor drains, where sleeves shall be extended ¾ inches above floor.

- 33.5 Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.
- 33.6 Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

PART 34 – WEATHERPROOFING:

- 34.1 Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
- 34.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 35 - OPERATING INSTRUCTIONS:

- 35.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.
- 35.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- 35.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 36 - SCAFFOLDING, RIGGING AND HOISTING:

- 36.1 The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

PART 37 – CLEANING:

- 37.1 The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible or all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

- 37.2 After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

PART 38 – PAINTING:

- 38.1 Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

PART 39 – INDEMNIFICATION:

- 39.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 40 - HAZARDOUS MATERIALS:

- 40.1 The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- 40.2 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- 40.3 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.
- 40.4 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

PART 41 - ABOVE-CEILING AND FINAL PUNCH LISTS:

- 41.1 The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

- 41.1.1 For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
- 41.1.2 For review of all other work as the project nears substantial completion.
- 41.2 When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.
- 41.3 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of \$75.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

PART 42 - DISPOSAL OF LAMPS (JCPS Projects):

- 42.1 The Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing fixtures.
- 42.2 Lamps removed from fluorescent, metal halide, mercury and sodium fixtures that do not have green end caps shall be placed by the Contractor in cardboard boxes furnished by JCPS for recycling. The contractor shall label each box with the type and quantity of lamps in each box and seal the box. Boxes shall be stored at the project site in an area safe from breakage, vandalism and fire.
- 42.3 Broken fluorescent, metal halide, mercury and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor and placed in a 55 gallon steel drum furnished by JCPS. The contractor shall reimburse JCPS for the cost to dispose of these broken lamps, which is approximately \$250.00 per drum.
- 42.4 Incandescent lamps and lamps and tubes with green end caps shall be legally disposed of by the Contractor.
- 42.5 Green end cap lamps and broken lamps shall not be placed in any box designated for recycling lamps.
- 42.6 When all lamps have been removed and properly stored, the Contractor shall notify JCPS that the lamps to be recycled are ready for pick-up by the JCPS Universal Waste Recycling Transporter. JCPS pays the cost to recycle these lamps.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260501 - DESCRIPTION OF ELECTRICAL SYSTEM

PART 1 - ELECTRICAL PRIMARY SERVICE:

- 1.1 Primary electrical service shall be underground, 12,470 volts, three phase, wye, to a pad-mount transformer as indicated on the plans.
- 1.2 Provide primary conduit, riser, concrete transformer pad, pull ropes, C/T installation and trenching in accord with Utility Company requirements.
- 1.3 In general, the utility company will provide the pad-mounted transformer, primary cable and its terminations. Riser conduit on utility pole and all other work shall be in accord with utility company requirements. Contact the utility company prior to bidding the work and include any and all charges for their work in bid.

PART 2 - SECONDARY SERVICE:

- 2.1 Secondary service shall be 277/480V/3Ø/4W with solid grounded neutral. See Electrical Riser Diagram. Trench, backfill, conduit, lugs, conductors, meterbase and CT cabinet (if required) by Electrical Contractor.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

PART 1 – GENERAL:

- 1.1 Each Electrical Contractor's attention is directed to Section 260500 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

PART 2 - SCOPE OF THE ELECTRICAL WORK:

- 2.1 The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:
 - 2.2 All conduits, conductors, outlet boxes, fittings, etc.
 - 2.3 All panels, disconnect switches, fuses, transformers, contactors, starters, etc.
 - 2.4 All wiring devices and device plates.
 - 2.5 All light fixtures and lamps.
 - 2.6 Electrical connection to all electrically operated equipment furnished and/or installed by others, including kitchen equipment.
 - 2.7 Telephone conduit system and cabinet.
 - 2.8 Inspection of electrical system by licensed Electrical Inspector.
 - 2.9 Grounding.
- 2.10 All necessary coordination with electric utility company, telephone company, etc., to insure that work connections, etc., that they are to provide is accomplished.
- 2.11 Paying all necessary fees and cost for permits, inspections, work by utility companies, etc. The Contractor shall contact the utility companies prior to submitting a bid to determine exactly what these charges will be.
- 2.12 Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and shall include such requirements in his base bid.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260503 - SHOP DRAWINGS, LITERATURE, MANUALS, PARTS LISTS, AND SPECIAL TOOLS

PART 1 - SHOP DRAWINGS:

- 1.1 Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.
- 1.2 If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.
- 1.3 Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- 1.4 The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.
- 1.5 No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.
- 1.6 In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:
- 1.7 Power Equipment:
 - 1.7.1 Switchgear and panelboards.
 - 1.7.2 Circuit breakers or fusible switches, per each type.
 - 1.7.3 Dry type transformers.

- 1.7.4 Liquid-filled pad mount transformers and their accessories.
- 1.7.5 Power and lighting contactors.
- 1.7.6 Disconnect switches.
- 1.7.7 Fuses, per each type required.
- 1.7.8 Magnetic starters, if not submitted with unit equipment by supplier.
- 1.7.9 Control components (relays, timers, selector switches, pilots, etc.)
- 1.7.10 Primary cable (over 600 volts) and each style of termination fitting for primary cable.
- 1.7.11 Building service grounding electrode components.
- 1.7.12 Metering devices.
- 1.7.13 Bus duct and each type of fitting for bus duct.
- 1.7.14 Emergency generator, engine fuel system and transfer switch, with all required generator system accessories, such as battery charger, batteries, exhaust system and its insulation, fuel pumps, day tanks, etc.
- 1.8 Raceways:
 - 1.8.1 Cable tray and each type of cable tray fitting.
 - 1.8.2 Wireways and each type of wireway fitting.
 - 1.8.3 Surface-mounted metal or plastic raceways, with each type of fitting.
- 1.9 Devices:
 - 1.9.1 Each type of wiring device and their coverplates.
 - 1.9.2 Floor boxes, each by type, with required accessories.
 - 1.9.3 Data/voice/video wallplates, each type.
 - 1.9.4 Any special items not listed above.
- 1.10 Lighting
 - 1.10.1 Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
 - 1.10.2 Lamps, each by type.
 - 1.10.3 Lighting standards or poles.
 - 1.10.4 Flexible modular wiring system with cutsheets and layout drawings.
 - 1.10.5 Photocells, time clocks or other lighting accessories.

1.11 Systems

- 1.11.1 Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also provide scale building layout drawings that indicate device placement, wiring, etc. Refer to specific system's specification for additional submittal requirements where required.
- 1.11.2 Fire alarm system
- 1.11.3 Security system
- 1.11.4 Building paging/intercom audio system
- 1.11.5 Clock/Program system
- 1.11.6 Telephone system
- 1.11.7 Video system
- 1.11.8 Data network
- 1.11.9 Sound reinforcement system (s)
- 1.11.10 Wireless intercom system
- 1.11.11 Miscellaneous
- 1.11.12 Control panel assemblies.
- 1.11.13 Non-standard junction/pullboxes.
- 1.11.14 Manholes, hand holes, and all outdoor electrical equipment and fittings.

PART 2 - SPECIAL WRENCHES, TOOLS AND KEYS:

- 2.1 Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

PART 3 - FIRE ALARM SHOP DRAWINGS:

- 3.1 The contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to submittal to the Commonwealth's Department of Housing, Buildings and Construction or other governing authority for their review.

PART 4 - MAINTENANCE AND OPERATION MANUALS:

- 4.1 Upon substantial completion of the project, the Electrical Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided. These documents shall at least include:

- 4.2 Detailed operating instructions.
- 4.3 Detailed maintenance instructions including preventive maintenance schedules.
- 4.4 Addresses and phone numbers indicating where parts may be purchased.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260504 - CUTTING, PATCHING AND REPAIRING

PART 1 – GENERAL:

- 1.1 The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.
- 1.2 The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.
- 1.3 The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.
- 1.4 The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- 1.5 Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.
- 1.6 Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.
- 1.7 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.
- 1.8 Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed.
- 1.9 All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.
- 1.10 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.
- 1.11 The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

- 1.12 All work improperly done or not done at all as required by the Electrical trades in this section will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING
AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

PART 1 – COORDINATION:

- 1.1 The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.
- 1.2 Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
- 1.3 The Contractor shall be responsible for coordination with all trades to insure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.
- 1.4 If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.
- 1.5 In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

PART 2 – INTERFACING:

- 2.1 Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is effected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):
 - 2.1.1 Connection of Telecommunications (voice, video, data) lines to Owner's existing or new services.
 - 2.1.2 Connection of Power lines to Owner's existing or new services.
 - 2.1.3 Connection of fuel oil and exhaust piping to emergency generator and furnishing of fuel for testing unit. Provide a full tank at final acceptance.
 - 2.1.4 Connection of all controls to equipment.

- 2.1.5 Electrical power connections to electrically operated (or controlled) equipment.
- 2.1.6 Electrical provisions for all equipment provided by other trades or suppliers within this contract.

PART 3 - CONNECTION OF EQUIPMENT FURNISHED BY OTHERS:

- 3.1 Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.
- 3.2 All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.
- 3.3 Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.
- 3.4 Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.
- 3.5 For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.
- 3.6 The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260515 – SPORTS LIGHTING SYSTEM

PART 1 – GENERAL:

1.1 RELATED DOCUMENTS

1.1.1 Furnish and install a complete, fully operational field lighting system. The system shall be installed complete and ready to operate as per attached specifications.

1.1.2 The Contractor shall furnish and install all equipment, wiring and material required for the installation of the specified system. Any and all material and equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of these specifications and drawings.

1.2 LIGHTING

1.2.1 Lighting Performance

1.2.1.1 The manufacturer shall supply lighting equipment to meet or exceed the following performance criteria:

1.2.2 Field Lighting

1.2.2.1 Performance Criteria

Performance Requirements: Playing surfaces shall be lit to an average constant light level and uniformity as specified in the chart below. Light levels shall be held constant for 25 years. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Measured average illumination level shall be +/- 10% of predicted mean in accordance with IESNA RP-6-01, and measured at the first 100 hours of operation.

Area of Lighting	Target Maintained Average Light Levels	Uniformity Ratio (Maximum to Minimum)	Grid Points	Grid Spacing
Softball Infield	30 footcandles	2.5: 1.0	16	30' x 30'
Softball Outfield	20 footcandles	3.0: 1.0	65	30' x 30'
Soccer Field	30 footcandles	2.5: 1.0	66	30' x 30'
Football Field	30 footcandles	2.5: 1.0	40	30' x 30'
Entire Area	28 footcandles	15.0: 1.0	383	20' x 20'

If a constant light level cannot be provided, a maximum Recoverable Light Loss Factor of 0.70 shall be applied to the initial light level design to achieve the following initial and maintained light levels:

Area of Lighting	Initial Average Light Levels	Target Maintained Average Light Levels	Uniformity Ratio (Maximum to Minimum)	Grid Points	Grid Spacing
Softball Infield	42.9 footcandles	30 footcandles	2.5: 1.0	16	30' x 30'
Softball Outfield	28.8 footcandles	20 footcandles	3.0: 1.0	65	30' x 30'
Soccer Field	42.9 footcandles	30 footcandles	2.5: 1.0	66	30' x 30'
Football Field	42.9 footcandles	30 footcandles	2.5: 1.0	40	30' x 30'
Entire Area	40.0 footcandles	28 footcandles	15.0: 1.0	383	20' x 20'

For alternate systems, lighting calculations for both initial and maintained light levels shall be submitted. If lighting system does not provide a series of timed power adjustments the above initial light levels must be met. Revised Electrical Distribution: Manufacturer shall provide revised electrical distribution plans to include changes to service entrance, panel, and wire sizing. Any required changes shall be included in bid.

Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, the pole mounting heights from the playing field surface shall be

60' for pole P1, P2, P4

70' for pole P3, P5, P6, P7

Refer to the civil drawings for pole location elevations relative to the playing surface.

1.2.2.1.1 Manufacturer shall submit computer-generated light scan showing the following:

1.2.2.2 Point-by-point horizontal foot-candles

1.2.3 Lighting controls

1.2.3.1 The light poles are to be controlled in 3 different zones for each field activity

Switching Schedule		
Field Type	Zones	Zone Description
Soccer/Softball	1,2	Softball
Soccer	1,2	Soccer
Football	2,3	Football

1.2.3.2

Zone Schedule				
Zone	Selector Switch	Zone Description	Circuit Descriptions	
			Pole ID	Contact ID
Zone 1	1	Soccer/Baseball	P4	C1
			P5	C2
			P6	C3
Zone 2	2	Softball/Baseball/Football	P3	C4
			P7	C5
Zone 3	3	Football	P1	C6
			P2	C7

1.3 ENVIRONMENTAL LIGHT CONTROL

1.3.1.1 Spill Light Control: Light levels shall not exceed the designated maximum footcandles or average footcandles shown below. These levels shall be shown as initial footcandles. Measured average illumination level shall allow a 10% variance of predicted mean in accordance with IESNA RP-6-01, and be measured at the first 100 hours of operation.

1.4 INSPECTION AND VERIFICATION

1.4.1 Testing Equipment

1.4.1.1 Testing equipment for measurement of foot-candle levels shall be United Technology's Digital Model #61, a Gossen Panalux Electronic 2 or an approved equal, and must show proof of calibration prior to testing as required by manufacturer.

1.4.2 Final Approval

1.4.2.1 At the completion of the project and in the presence of the appropriate parties, actual light performance meter readings shall be taken and verified. Initial light levels and uniformities are guaranteed per specifications at time of initial start up. At 100 hour burn in, light levels will be +-10% on the initial specified light levels per IES RP-6-01.

1.4.2.2 Should the lighting performance not meet the specified criteria, the contractor shall be responsible to bring the lighting system into compliance. Should additional fixtures be required, the contractor shall be responsible for all material and labor, as well as any associated changes in the electrical system and pole/foundation designs. (Results assume +-3% nominal voltage at load side of electrical enclosure, fixtures properly aimed to field and poles located within 3' of design location.)

PART 2 – PRODUCTS:

2.1 LIGHTING SYSTEM CONSTRUCTION

2.1.1 General Description: Basis of design: Musco's Light-Structure Green™ System is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

2.1.2 Design Approval: The owner / engineer will review pre-bid shop a drawing from the manufacturer's to ensure compliance to the specification. If the design meets the design requirements of the specifications, a letter will

- be issued to the manufacturer indicating approval for the specific design submitted.
- 2.1.3 Lighting system shall consist of the following: Galvanized steel poles and cross-arm assembly
 - 2.1.4 Pre-stressed concrete base embedded in concrete backfill. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation be located a minimum of 18 inches above final grade. Anchor bolt foundation concrete must cure for a minimum of 28 days before the pole stress is applied. Direct bury steel (including steel pin base) and concrete poles are not acceptable.
 - 2.1.5 All luminaires shall be constructed with a die-cast aluminum housing to protect the luminaire reflector system. If die-cast housing is not available, spun aluminum with a hair shroud is acceptable.
 - 2.1.6 Lamps producing more than 155,000 lumens will not be allowed due to rapid depreciation.
 - 2.1.7 Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10' above grade. The enclosures shall include ballast, capacitor and fusing for each luminaire. Safety disconnect per circuit for each pole structure will be located in the enclosure.
 - 2.1.8 Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
 - 2.1.9 Controls and Monitoring Cabinet to provide on-off control and monitoring of the lighting system constructed of NEMA Type 4 aluminum. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual Off-On-Auto selector switches shall be provided.
 - 2.1.10 Service Platforms –Floor of service platform shall be approximately 26 inches by 62 inches for a 2 Light Bar; 26 inches by 115 inches for a 4 Light Bar; and 26 inches by 170 inches for a 6 Light Bar. Centered in the platform shall be an access door hinged to open to the rear. The mounting supports on the platform shall be C3x5 channel and C4x7.25 channel. The floor shall be all welded construction. The back rail and side rails shall be at least 43 inches high. The side rails, back rail, platform, and light bar shall bolt together for one integral unit. The platform shall be fastened to the pole in two places using galvanized threaded rods and galvanized straps. Platform shall be hot-dip galvanized ASTM A123 standards for long-term durability.
 - 2.1.11 Pole Climbing Steps, Safety Cable and Safety Harness –Steel climbing steps shall begin approximately 15 feet above ground and shall be staggered on 15 inch centers to top of pole. Steps shall be grade 5-3/4 inches by 7 inch long round head bolts, hot-dip galvanized meeting ASTM-A307. Bolts shall be fastened to brackets welded to the pole by two 3/4 inch square nuts. Poles shall be equipped with 3/8 inch galvanized safety cable at step initiation and attached at top and bottom with welded brackets. An OSHA approved safety harness and climbing device assembly shall be supplied to the owner for use with safety cable assembly attached to the pole.
 - 2.1.12 Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.
 - 2.1.13 Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed steel shall be hot dip galvanized per ASTM A123. All exposed hardware and fasteners shall be stainless steel of at least 18-8 grade, passivated and polymer coated to prevent possible galvanic corrosion to adjoining metals. All exposed aluminum shall be powder coated with high performance polyester. All exterior reflective inserts shall be anodized, coated with a clear, high gloss, durable fluorocarbon, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
 - 2.1.14 Lightning Protection: All structures shall be equipped with lightning protection meeting NFPA 780 standards. Contractor shall install ground rod per section.

2.1.15 All system components shall be UL Listed for the appropriate applications.

2.2 STRUCTURAL PARAMETERS

2.2.1 Support Structure Wind Load Strength: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be determined based on the 2006 edition of the IBC Building Code, wind speed of 90, exposure category C. Luminaire, visor, and cross-arm shall withstand 150 mph winds and maintain luminaire aiming alignment. Foundation design will be based on 2006 IBC.

2.2.2 Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 1994.

2.2.3 Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2003 IBC, Table 1804.2

2.2.4 Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

2.2.5 Manufacturer's Warranty – 25 years.

2.2.6 The manufacturer shall warrant the entire lighting system consisting of poles, foundations, luminaire assembly, remote ballast enclosures, wire harnesses and controls/monitoring equipment in writing for a period of TWENTY-FIVE (25) years. Any parts that shall be found defective shall be replaced free of labor charge. Fuses shall not be warranted but shall be provided as needed at no charge to the owner for the 25 year warranty period. The owner will agree to check and change fuses in the event of a lamp outage prior to service work being scheduled.

2.2.7 Aiming, Spill Control and Light Level Warranty

2.2.8 The alignment of the luminaire shall be warranted by the manufacturer against movement on the luminaire assembly for a period of TWENTY-FIVE (25) years from the date of installation. Labor and equipment charges for re-aiming during the warranty period shall be the responsibility of the manufacturer. Spill light levels at pre-determined points shall be guaranteed by the manufacturer to be at the level specified for this project for a period of TWENTY-FIVE (25) years. Readings shall be provided by manufacturer and shall be within the illumination Engineering Society of North America RP-6-01 Standards of +/- 10% of the design criteria.

2.2.9 Manufacturers providing average constant light levels: Average constant light levels shall be guaranteed to meet light levels in section 1.2.2.1 by manufacturer for a period of 25 years within the Illumination Engineering Society of North America RP-6-01 standard of +/-10% of the design criteria. The lamp operation, system performance, and operating hour usage shall be electronically monitored by an internet based control system. This includes on/off status, lamp outages, web site scheduling via phone, fax or email and access to trained staff available 24/7 to provide scheduling support and regular reporting back to the customer should problems occur. All communication and service costs to provide controls and monitoring shall be included in the 25 year warranty. When light levels can no longer be maintained at the constant illumination levels specified above, manufacturer will provide for lamp replacement schedule as outlined below for 5000 hour rated lamps.

2.2.10 Manufactures providing initial/maintained lighting levels: Initial average light levels shall be guaranteed by the manufacturer to meet light levels in section 1.2.2.1 upon 100 hours initial burn in of the lighting system, within the Illumination Engineering Society of North America RP-6-01 standard of +/-10% of the design criteria. The lamp operation, system performance, and operating hour usage shall be electronically monitored by an internet based control system. This includes on/off status, lamp outages, web site scheduling via phone, fax or email and access to trained staff available 24/7 to provide scheduling support and regular reporting back to the customer should problems occur. All communication and service costs to provide controls and monitoring shall be

included in the 25 year warranty. Once light levels reach the targeted maintained light levels specified above. The manufacturer will provide for lamp replacement schedule as outlined below for 3000 hour rated lamps.

- 2.2.11 Lamp Warranty: Lamps shall be warranted for full replacement cost including labor for 25 years. The expected usage hours for the multipurpose field will be 500 hours per year.
- 2.2.12 For 5000 hour rated lamps and constant illumination, manufacturer shall re-lamp at year 10 and 20. Individual lamps shall also be replaced at no charge to the owner throughout the warranty period. When individual lamp outages materially impact the playability of a field during the 25-year warranty period, the manufacturer shall at no charge to owner provide, install and re-aim all lamps as needed. For this project, materially impact is defined as more than one lamp per pole or 10% of the total installed lamps on one field.
- 2.2.13 For 3000 hour rated lamps, manufacturers shall re-lamp at year 7, 14 and 21. Individual lamps shall also be replaced at no charge to owner throughout the warranty period. When individual lamp outages materially impact the playability of a field during the 25-year warranty period, the manufacturer shall at no charge to owner provide, install and re-aim all lamps as needed. For this project, materially impact is defined as more than one lamp per pole or 10% of the total installed lamps on one field.
- 2.2.14 The manufacturer shall furnish to the owner of the facility 5 extra fuses for future use.
- 2.2.15 Warranty - The Lighting Contactor Cabinet shall be covered for the warranty specified for the lighting system.
- 2.3 DOCUMENTATION
- 2.3.1 Bidders wishing to provide alternate equipment shall submit the following product information 10 days prior to bid:

SUBMITTAL INFORMATION

Design Submittal Data Checklist and Certification

All items listed below are mandatory to comply with the specification

Included	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	On Field Lighting Design	Lighting design drawing(s) showing: <ul style="list-style-type: none"> a. Field Name, date, file number, prepared by, and other pertinent data b. Outline of field(s) being lighted, as well as pole locations referenced to the middle of the field. Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of meter above field surface e. Summary table showing the number and spacing of grid points; average, minimum and maximum

			illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor. f. Alternate manufacturers shall provide both initial and maintained light scans using a maximum 0.70 Light Loss Factor to calculate maintained values.
	C	Off Field Lighting Design	Lighting design drawing showing maximum initial vertical spill light levels and maximum initial horizontal light levels along the west side at the chain link fence in foot-candles. Vertical levels shall be at 30-foot intervals along the chain link fence and equal 26 points. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank lights.
	d	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Ohio.
	D	Control and Monitoring	Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system.
	E	Electrical distribution plans	If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Ohio.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 25 years.
	G	Warranty	Provide written warranty information including all terms and conditions.
	H	Project References	Manufacturer to provide a list of project references of similar products completed within the past three years.
	I	Product Information	Complete set of product brochures for all components, including a complete parts list and UL Listings.
	J	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications.
	K	Compliance	Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance

Manufacturer: _____

Signature: _____

Contact Name: _____

Date: ____/____/____

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260519 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES & CONNECTORS

PART 1 – GENERAL:

- 1.1 This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.
- 1.2 All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.
- 1.3 **No more than 40% conduit fill is permitted for any conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.**
- 1.4 No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.
- 1.5 If circuits originate from data equipment supply panels provided with local surge suppression, the circuit neutral shall not be shared, as in an Edison circuit. Pull separate neutrals for each phase. In these cases, a maximum of seven conductors is permitted in a conduit. Conductors shall be derated per N.E.C.
- 1.6 If more than three phases are installed in a single raceway, an additional equipment grounding conductor and neutral shall be installed as indicated by the number of phase conductors.

PART 2 – MATERIALS:

2.1 CONDUCTORS

- 2.1.1 All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.
- 2.1.2 Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.
- 2.1.3 Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.
- 2.1.4 Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes.
- 2.1.5 All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.
- 2.1.6 The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to 260519-PART 4, Color Coding.
- 2.1.7 All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.
- 2.1.8 Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.

- 2.1.9 Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.
- 2.1.10 All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.
- 2.1.11 Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop.

2.2 SPLICING DEVICES & CONNECTORS

- 2.2.1 Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.
- 2.2.2 Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.
- 2.2.3 Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.
- 2.2.4 Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.
- 2.2.5 Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.
- 2.2.6 Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.
- 2.2.7 The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.
- 2.2.8 No aluminum conductors shall be used.

PART 3 – INSTALLATION:

- 3.1 The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.
- 3.2 The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.
- 3.3 Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent.
- 3.4 Where indicated, communications conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Nylon tie-wraps shall be installed in such a manner so as to bundle

conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.

- 3.5 Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.
- 3.6 Where conductors are installed in industrial facilities, they shall be per J.I.C. standards.
- 3.7 Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.

PART 4 - COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS:

- 4.1 Conductors to be color coded as follows:
 - 4.1.1 120/208 Volt Conductors
 - Phase A - Black
 - Phase B - Red
 - Phase C - Blue
 - Neutral - White
 - 4.1.2 277/480 Volt Conductors
 - Phase A - Brown
 - Phase B - Orange
 - Phase C - Yellow
 - Neutral - Gray, or white with brown tracer
 - 4.1.3 Isolated Power Conductors (Type XLP or XHHN)
 - Phase A - Brown
 - Phase B - Orange
 - Phase C - Yellow
 - Neutral - White with brown tracer stripe
 - 4.1.4 Note: Further identify isolated power conductors with ½" wide purple tape at all terminations and junctions.
 - 4.1.5 Control Wiring - Red, or as indicated.
 - 4.1.6 Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with ½" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.
 - 4.1.7 D.C. Wiring - Positive - Light Blue
Negative - Dark Blue

PART 5 - COMMUNICATIONS CONDUCTORS:

- 5.1 Communications conductors shall be of type suitable for the service, installed in accordance with the manufacturer's recommendations for pulling tensions, support, terminations, proximity to high power

fields, etc. Types not indicated on this schedule but indicated on plans shall be as noted or required for the service. If in doubt, contact the Engineer for clarification.

- 5.2 Plenum-rated conductors (per N.E.C.) shall be installed where required by codes. If installation is thru an approved raceway system that excludes the wiring from the plenum, non-plenum type may be used.
- 5.3 All communications cables shall be furnished and installed in compliance with U.L. 444, U.L. 13, N.E.C. 800, 725, 760 and all applicable codes and standards, for premises or riser installations.
- 5.4 Riser cables shall be provided in accord with current edition of the N.E. Code.

5.5 Schedule of Wiring Types - Plenum-Rated

Data Circuits	24 AWG, 4 Pair Certified Category Five U.T.P. Plenum-Rated	Anixter #CMP-00424 FAS-5B Belden Equivalent Berk-Tek Equivalent A.T.&T. Equivalent
Voice Circuits	24 AWG, 4 Pair Certified Category Five U.T.P. Plenum-Rated	Anixter #CMP-00424 FAS-5B Belden Equivalent Berk-Tek Equivalent A.T.&T. Equivalent
Voice Circuits	24 AWG, 4 Pair Category Three U.T.P. Plenum-Rated	Anixter #CMP-00422 HAH-3 Belden Equivalent W.P.W. Equivalent
Video Drops	RG-6/U Coaxial, 18 AWG Solid Conductor, Plenum-Rated	Belden #89120 Anixter Equivalent Berk-Tek Equivalent
Video Trunks	RG-11/U Coaxial, 14 AWG Solid Conductor, Plenum-Rated	Belden #89292 Anixter Equivalent Berk-Tek Equivalent
T-1 Premises Extension Cable	T-1, 4 Pair 22 AWG, Plenum-Rated Pairs Individually Shielded	Anixter #CMP-00422T1-3 Belden Equivalent Berk-Tek Equivalent
12-Strand Fiber (or # of Strands as Noted)	Multimode 62.5/125 Micron, Plenum-Rated	Anixter #370-949-FDDI-12 Siecor Equivalent Berk-Tek Equivalent
Speaker Cable	22 AWG. 1 Pair Shielded	Belden #88761 W.P.W. Equivalent Anixter Equivalent
Speaker Cable, with Call-In Unshielded Pair	22 AWG. 1 Pair Shielded, 1 Pair 22 AWG. Unshielded	Belden #88723 W.P.W. Equivalent Anixter Equivalent
100 Pair Telephone Cable	24 AWG. 100 Pairs, Non-Plenum Exchange Cable, Wet Location Rated, Gel-Filled Certified Category Three	Anixter #E-010024DFC Belden Equivalent A.T.&T. Equivalent

OR

A. Schedule of Wiring Types - Non-Plenum Rated

Data Circuits	24 AWG, 4 Pair Certified Category Five U.T.P.	Anixter #CM-00424 CAG-5B Belden Equivalent Berk-Tek Equivalent
Voice Circuits	24 AWG, 4 Pair Certified Category Five U.T.P.	Anixter #CM-00424 CAG-5B Belden Equivalent Berk-Tek Equivalent
Voice Circuits	24 AWG, 4 Pair Category Three U.T.P.	Anixter #CM-00422 BAG-3 Belden Equivalent W.P.W. Equivalent
Video Drops	RG-6/U Coaxial 18 AWG Solid Conductor	Belden #9060 Anixter Equivalent W.P.W. Equivalent
Video Trunks	RG-11/U Coaxial, 14 AWG Solid Conductor	Belden #1523A Anixter Equivalent W.P.W. Equivalent
T-1 Premises Extension Cable	T-1, 4 Pair 22 AWG, Pairs Individually Shielded	Anixter #CM-00422 MIGT-3 Belden Equivalent Berk-Tek Equivalent
12-Strand Fiber (or # of Strands as Noted)	Multimode 62.5/125 Micron	Anixter #370-647-FDDI-12 Siecor Equivalent Berk-Tek Equivalent
Speaker Cable	22 AWG. 1 Pair Shielded, Plenum-Rated, Stranded	Belden #9414 Equivalent W.P.W. or Anixter
Speaker Cable with Call-In Pair	22 AWG. 1 Pair Shielded, 1 Pair 22 AWG. Unshielded for Call-In, Plenum-Rated	Belden #8730 W.P.W. Equivalent Anixter Equivalent
100 Pair Telephone Cable	24 AWG. 100 Pairs, Non-Plenum Exchange Cable, Wet Location Rated, Gel-Filled, Certified Category Three, Installed in Metal Conduit	Anixter #E-010024DFC Belden Equivalent A.T.&T. Equivalent

PART 6 - HIGH VOLTAGE PRIMARY CABLE:

- 6.1 High voltage primary cable shall be rated for aerial, direct burial, open tray, wet location and submersible underground service. Cable shall be I.P.C.E.A. - listed and UL listed for the use indicated.
- 6.2 Cable shall be rated 15 K.V., nominal. Insulation shall be XLP, XLPE or approved equivalent with a nominal 133% value.
- 6.3 Cable shall be shielded, grounded, with extruded 8 mil. semiconducting layer bonded to the insulation. Provide with copper drain wires served over semiconducting layer.

- 6.4 Cable shall be installed in accordance with manufacturer's recommendations, with particular attention to termination, handling, bending radii and pull tension recommendations.
- 6.5 The conductor shall be copper with Class "B" stranding per ASTM B-8.
- 6.6 Cable shall be as manufactured by G.E., Anaconda, Phelps-Dodge, Okonite, or approved equivalent.
- 6.7 Cable shall be manufactured per the following standards: UL 1072 and ICEA for medium voltage cable.
- 6.8 Cable shall be terminated at pad-mount transformer or as indicated with pre-manufactured load-break, dead-front elbows and fittings compatible with cable and rated for the purpose. Pre-manufactured elbows and other types of fittings indicated shall be as manufactured by Elastimold Co., Blackburn-ITT, R.T.E. Corporation, S & C Company or other approved equivalent.
- 6.9 Cable terminators for 15 K.V., 200 ampere connection shall be ANSI Standard 386-1877 200 amp hot-stick operable load break elbow with voltage test point. The elbow shall be furnished with the necessary cable adapter for terminating the copper cable used.
- 6.10 Electrical ratings shall be as follows:
 - 6.10.1 Voltage 15 KV class
 - 6.10.2 Continuous and Load Break Current 200 amps, rms
 - 6.10.3 BIL 95 KV
 - 6.10.4 Withstand Voltage (AC) 34 KV, 60 HZ, 1 minute
 - 6.10.5 Short-Time Current 10,000 amps, rms, sym., .17 seconds.
- 6.11 Cable terminators for 15 K.V., 600 ampere connection shall be ANSI Standard 368-1977 premolded dead break unit for terminating 15 KV shielded cable. The connector shall be fully shielded, of dead front operation and shall be fully submersible. The connector shall be furnished with proper adapters for terminating the copper cable used.
- 6.12 The connectors shall have the following ratings:
 - 6.12.1 Voltage 15 KV Class
 - 6.12.2 Continuous Current 600 amps, rms
 - 6.12.3 BIL 95 KV
 - 6.12.4 8 Hour Overload 900 amps, rms
 - 6.12.5 Withstand Voltage (AC) 35 KV, 60 Hz, 1 minute
 - 6.12.6 Momentary 25,000 amps, rms, sym, .17 seconds.
- 6.13 Cable shall be color coded at all terminations and junctions as follows:
 - 6.13.1 Phase A - Black
 - Phase B - Red
 - Phase C - Blue

- 6.14 Follow the above color coding unless otherwise indicated or required by system user.
- 6.15 Cable grounding at all terminations shall be in accord with the manufacturer's recommendations and applicable codes.
- 6.16 A full size (matching phase conductors) copper 600 volt insulated ground is to be provided with each primary circuit.
- 6.17 Installation, termination and testing of primary power cables shall be accomplished by Journeymen Electricians with at least three years experience with such work.
- 6.18 In lieu of using pre-manufactured elbows and other fittings, installer may substitute field-build and taped stress cones or other type of termination, subject to written prior approval of the engineer. In requesting such approval, submit complete data on materials proposed to be used and tools to be used in cutting and stripping cable.
- 6.19 All new primary cable shall be high-potential tested in accord with criteria outlined herein. Where taps, splices or terminations to existing primary cables are indicated on the plans, the Engineer reserves the right to request high-potential testing of the existing cable or systems to determine their suitability and safety, if not so indicated on the plans.
- 6.20 Always field verify exact primary power voltage potentials with the supplying utility and report any discrepancy from that indicated on the plans to the Engineer prior to placing any primary cable in service.

PART 7 - TESTING OF PRIMARY CABLE:

- 7.1 All new primary cable shall be tested prior to energization in accord with the following criteria, or other approved method.
 - 7.1.1 Use equipment made by one of the following (or approved equivalent) and abide by their operation rules for their respective equipment:
 - 7.1.1.1 Associated Research, Inc
 - 7.1.1.2 J.G. Biddle Company
 - 7.1.1.3 Hipotronics, Inc.
 - 7.1.1.4 Von Corporation
 - 7.1.2 Clear cable of all equipment, switchgear, etc. for elbows, install insulation plugs. On cable end, insulate by high voltage taping, insulating jar or plastic. All terminations and splices shall be completely and properly grounded. All adjacent equipment shall be grounded, where danger of flashover exists.
 - 7.1.3 A sphere gap in parallel with the 100,000 volt D.C. "Hipot" tester shall be calibrated for sparkover at 70 KV D.C.
 - 7.1.4 The direct current test voltage shall be applied in increments of 5 KV and shall be left at the step for 1 minute. Saturate cable for 15 minutes at test voltage as in (5) below.
 - 7.1.5 Test: (as appropriate)
 - 7.1.5.1 15 KV cables with open terminations at 55 KV D.C.

- 7.1.5.2 15 KV cables with elbow termination at 45 KV D.C., or to the limit of the elbow or splice. Verify with manufacturer.
- 7.1.5.3 SPECIAL NOTE: It is suggested that tests be performed when relative humidity is 50 to 60% or less in clear, dry weather for greater safety.
- 7.1.6 Record the leakage current at each step and at end of saturation time.
- 7.1.7 Acceptance: The above procedure with less than 100 microamperes of current registered.
- 7.1.8 Proof test on existing cable at 35 KV for 5a and 35 KV for 5.2 above.
- 7.1.9 After test (in order listed):
 - 7.1.9.1 Turn tester power off.
 - 7.1.9.2 Discharge tester and cable thru a resistive discharge device (8 MEGOHM discharge stick).
 - 7.1.9.3 Ground cable thru a grounding means (#12 AWG THW wire to ground).
 - 7.1.9.4 Disconnect tester.
- 7.1.10 For Safety:
 - 7.1.10.1 Wear high voltage gloves at all times.
 - 7.1.10.2 Treat cable and tester as high voltage at all times.
 - 7.1.10.3 Remember, D.C. static charges can be very harmful.
- 7.1.11 All tests must be made in the presence of the Engineer and shall be recorded on a form sheet signed by the person performing the test and dated. Three (3) copies shall be submitted to the Engineer. Provide 48 hour advance written notice to Engineer.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260526 - GROUNDING

PART 1 – GENERAL:

- 1.1 All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.
- 1.2 The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.
- 1.3 Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.
- 1.4 The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.

PART 2 – MATERIALS:

- 2.1 Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.
- 2.2 All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermally welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent.
- 2.3 Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.
- 2.4 Ground electrode pipe systems shall be solid copper construction. Ground rods shall be 5/8" minimum diameter, eight feet long, copperweld steel. All ground electrode systems shall be installed in accord with manufacturer's recommendations, U.L. listings, National Electrical and National Electrical Safety Codes.

PART 3 – INSTALLATION:

- 3.1 All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.
- 3.2 All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".
- 3.3 Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

- 3.4 Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.
- 3.5 All circuits shall have a separate grounding conductor, except as otherwise noted.
- 3.6 When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.
- 3.7 Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of generators, transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.
- 3.8 The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.
- 3.9 Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermally welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.
- 3.10 Where lightning protection systems are utilized on the work, their electrodes and conductors shall be electrically segregated from the building service ground, except where connections to structural elements are required for the proper installation of these systems. Lightning protection grounds shall only be utilized for lightning grounding applications, in accord with U.L. and manufacturer's recommendations.
- 3.11 Grounding connections shall **never** be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.
- 3.12 Where dielectric fittings are utilized in piping systems, the piping system shall **not** be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall **not** be utilized as ground paths except where specifically required by codes in the case of water piping.

PART 4 - GROUNDING ELECTRODE SYSTEM:

- 4.1 The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.
- 4.2 Ground system shall be an electrolytic rod type, as manufactured by Lyncole XIT Grounding, Superior Grounding Systems, L.E.C., Inc. (Chem-Rod), or approved equivalent. Electrode(s) shall be placed as shown on the plans, installed exactly per manufacturer's recommendations. Electrodes shall be installed vertically, 12 feet of overall length (or length as indicated), set in a drilled hole and backfilled per manufacturer's instructions with a special clay slurry surrounding the rod. Provide a concrete protection box with cast iron grate for the top of the rod termination. Ground system shall be per the following:
 - 4.2.1 Manufacturer: Lyncole XIT Grounding (or approved equivalent).
 - 4.2.2 Source: Lyncole XIT Grounding, 22412 S. Normandie Ave., Torrance, CA 90502 1-800-962-2610
 - 4.2.3 Shaft Configuration: Straight.

- 4.2.4 Shaft Length: 12 feet (or as otherwise indicated).
- 4.2.5 Listings: U.L.-467J, ANSI 633.8.
- 4.2.6 Material: Type K Copper.
- 4.2.7 Construction: Hollow tube, 2.125" O.D., chemical filled with non-hazardous metallic salts.
- 4.2.8 Weight 3.5 lbs. per foot of length, nominal.
- 4.2.9 Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point.
- 4.2.10 Average Life Expectancy: 25 Years.
- 4.2.11 Model Number: K2-(length)CS.
- 4.2.12 Provide grounding system with the following components: protective box, backfill material. Box to be concrete with cast iron, tamper-resistant lid, backfill to be "Bentonite" clay.
- 4.3 Installation of Pipe Ground System:
 - 4.3.1 **Pipe ground systems shall be installed exactly as required by the system manufacturer. The Contractor shall be diligent to observe the excavation, sealing tape removal, slurry backfill and all other critical requirements.**
 - 4.3.2 **Note: NEVER USE SAND OR ORDINARY EARTH AS A BACKFILL MATERIAL**
 - 4.3.3 Pipe grounding system shall be warranted unconditionally by the Contractor for a period of one year from the date of substantial completion.

PART 5 - GROUND TESTING PROCEDURE:

- 5.1 The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.
- 5.2 The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).
- 5.3 For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.
 - 5.3.1 Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.
 - 5.3.2 Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.

- 5.3.3 Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the $E/I=R$ resistance readings on a graph at each point.
- 5.3.4 The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.
- 5.3.5 At completion of testing, remove reference electrode C2 and all temporary wiring and connections.
- 5.4 If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential achieved.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260531 - CABINETS, OUTLET BOXES & PULL BOXES

PART 1 – GENERAL:

- 1.1 This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.
- 1.2 Continuous runs of conduit shall have pull boxes at least each eighty-five (85) feet of run, or as near as possible to that limit.

PART 2 - MATERIALS & INSTALLATION:

2.1 Cabinets, Outlet & Pull Boxes:

- 2.1.1 Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted
- 2.1.2 All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.
- 2.1.3 Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers, and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.
- 2.1.4 Special size concealed outlet boxes for clocks, speakers, alarms, TV, etc., shall be provided by the manufacturer of the equipment.
- 2.1.5 Floor outlet boxes shall be as specified in Section 262726, fully adjustable unless noted or specified otherwise.
- 2.1.6 Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to center of box:
 - 2.1.6.1 Wall Switches, Control Stations 4'-0"
 - 2.1.6.2 Convenience Outlets 1'-6"
 - 2.1.6.3 Convenience Outlets - Above Counters Bottom at 2" above top of backsplash
 - 2.1.6.4 T.V. Outlets 1'-6"
 - 2.1.6.5 T.V. Outlets - At Wall Brackets 7'-2"
 - 2.1.6.6 Desk Telephones 1' -6"
 - 2.1.6.7 Wall-Mounted Telephones 4'-6"

- 2.1.6.8 Weatherproof Outlets 2'-2"
- 2.1.6.9 Disconnects, Branch Panelboards 5'-0" max. to centerline
- 2.1.6.10 Fire Alarm Man. Stations 3'-6"
- 2.1.6.11 Fire Alarm Horns 80" AFF or 6" below ceiling,
whichever is lower
- 2.1.7 The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the A-E before this change is made.
- 2.1.8 All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.
- 2.1.9 Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved as equivalent.
- 2.1.10 NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
- 2.1.11 Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 4" X 4" X 2-1/8" with plaster cover for the number of devices as required and to be flush with finished wall. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls.
- 2.1.12 Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.
- 2.1.13 Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.
- 2.1.14 Outlets provided shall have only the holes necessary to accommodate the conduit at the point of insulation and shall be rigidly secure in position. Boxes with knockout removed and openings not used shall be replaced or provided with a listed knockout closure.
- 2.1.15 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.
- 2.2 SPECIAL NOTICE
- 2.2.1 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260533 - RACEWAYS & FITTINGS

PART 1 – GENERAL:

- 1.1 This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.
- 1.2 This section specifies basic materials and methods and is a part of each Electrical Section that implies or refers to electrical raceways specified therein.
- 1.3 The types of raceways specified in this section include the following:
 - 1.3.1 Steel electrical metallic tubing. (E.M.T.)
 - 1.3.2 Rigid galvanized steel conduit. (G.R.S.)
 - 1.3.3 Intermediate metal conduit (I.M.C.).
 - 1.3.4 Rigid aluminum conduit.
 - 1.3.5 Flexible metal conduit (aluminum or steel)
 - 1.3.6 Liquid - tight flexible metal conduit.
 - 1.3.7 Rigid nonmetallic conduit.
 - 1.3.8 Surface metal raceways.
 - 1.3.9 Wireways, wall ducts and trench ducts.
 - 1.3.10 Cable tray or cable trough.
 - 1.3.11 Duct banks, and their construction.
- 1.4 All raceways, as listed in 1.3 above and otherwise specified herein shall be provided in compliance with latest editions of all applicable U.L., NEMA, N.E.C. and A.N.S.I. standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.
- 1.5 Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.
- 1.6 P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.
- 1.7 The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.
- 1.8 Minimum size of conduit shall be ½ " trade size, except where installed in inaccessible locations, in which case a ¾ " minimum trade size shall be used, unless otherwise noted on the drawings. Switch legs may be

½ " trade size. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.

- 1.9 The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

PART 2 – MATERIALS:

2.1 STEEL ELECTRICAL METALLIC TUBING

- 2.1.1 Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer.

2.2 RIGID GALVANIZED STEEL CONDUIT

- 2.2.1 Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C. conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.

- 2.2.2 Rigid galvanized steel conduit shall be used for all building interior power wiring for cables of over 600 Volts.

2.3 INTERMEDIATE METAL CONDUIT

- 2.3.1 Unless otherwise indicated on the drawings, intermediate metal conduit (I.M.C.) may be used in any location in place of rigid galvanized steel conduit, as permitted by codes, and as approved by the Engineer.

2.4 RIGID ALUMINUM CONDUIT

- 2.4.1 Rigid aluminum conduit, shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel.

2.5 FLEXIBLE METAL CONDUIT

- 2.5.1 Flexible conduit may be used where permitted by NEC and these specifications. It shall be constructed of steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Flexible metal conduit shall not be used in lengths over six feet.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- 2.6.1 Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof.

2.7 RIGID NON-METALLIC CONDUIT

- 2.7.1 Rigid non metallic conduit shall be constructed of P.V.C, nominally schedule 40 weight, except where encased in concrete, where it may be "EB" type. If installation will enclose utility company provided conductors, verify exact type required. and install in accord with their standards, where more stringent than this specification in normal building conditions.
- 2.7.2 Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid nonmetallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.
- 2.7.3 Where rigid non metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab. Transition may then be made to E.M.T or other approved conduit for remainder of run.
- 2.7.4 Flexible nonmetallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.
- 2.7.5 Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.

2.8 SURFACE METAL RACEWAYS

- 2.8.1 Surface metal raceways shall be constructed of code gauge corrosion-resistant galvanized steel or aluminum extrusions, and finished in an ivory, buff or grey color as selected by the Architect. Finishes shall be suitable for field painting, prepared by the installing contractor as necessary.
- 2.8.2 Surface metal raceways, where used as raceways only, shall be sized for the conductors indicated. Nominal minimum size of such raceways shall be equivalent to Wiremold Co. Series #700, or equivalent by Walkerduct, Isotrol or other approved manufacturer.
- 2.8.3 Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans. These shall be Wiremold Co. #2200 Series or equivalent Walkerduct, Isotrol or other approved manufacturer.
- 2.8.4 Surface metal raceways and all components and fittings shall be furnished by a single manufacturer, wherever practical. All trim and cover fittings, flush feed boxes, splices, outlet fittings, etc, necessary for a complete installation shall be provided by the installing contractor. These raceways shall be rigidly mounted with approved fasteners on not to exceed 24" centers in a run, or 6" from ends and on either side of a corner. Refer to plans for notations on exact types of these raceways and outlet configurations.

2.9 WIREWAYS, WALL DUCT, FLUSH FLOOR TRENCH DUCT

2.9.1 WIREWAYS

- 2.9.1.1 Wireways of painted steel construction shall be corrosion-resistant, moisture and oil resistant where indicated or necessary. Wireways shall be furnished in nominal sizes of 2 ½" X 2 ½", 4" X 4", 6" X 6", 8" X 8" or 12" X 12", as indicated on plans. Furnish with hinged covers on all runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.

2.9.1.2 Provide wireways with hangers of same manufacturer, installed so as to allow unobstructed access to wireway interior. Install at not to exceed 8'-0" centers, closer as needed at fittings and turns. Use ¼ " rod hangers minimum for up to 4"X 4", 3/8 " rod minimum up to 8"X 8", ½ " rod minimum for 12" X 12".

2.9.1.3 Wireways shall be equivalent to Square "D" Co. "LD" series, as a minimum standard of construction and quality.

2.9.2 WALL DUCTS

2.9.2.1 Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 ½ " deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommeted openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.

2.9.2.2 Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.

2.9.2.3 Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.

2.9.2.4 All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.

2.9.2.5 Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

2.9.3 TRENCH DUCTS

2.9.3.1 Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 ½ ", minimum 12" width unless otherwise noted on plans.

2.9.3.2 Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.

2.9.3.3 Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.

2.9.3.4 Furnish coverplates of aluminum, ¼ " thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommeted openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.

2.9.3.5 Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.

2.9.3.6 Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

2.10 CABLE TRAY OR CABLE TROUGH

- 2.10.1 Cable tray shall be furnished in all-aluminum construction or galvanized steel construction, as noted and sized on the drawings.
- 2.10.2 Galvanized finishes on tray shall be hot-dipped after fabrication for all tray in exterior locations. Mill finished galvanizing may be used where tray is installed indoors in dry locations.
- 2.10.3 The installing contractor shall carefully follow the manufacturer's recommendations for hanger sizing and hanger support spacing. The weight per linear foot of tray, fully loaded with a 200% safety factor shall be accounted for in sizing hangers. Refer to manufacturer's instructions and/or the drawings, as applicable for hangers and supports. In no case shall supports be spaced further than 8'-0" apart.
- 2.10.4 Cable tray shall be of the ladder type with rungs spaced 12" apart. Side rails shall be of I-Beam or C-Channel construction with welded rungs, depth and width as indicated on the drawings.
- 2.10.5 Cable trough shall be similar to cable tray, except bottom shall be a ribbed solid piece, depth and width as indicated on the drawings.
- 2.10.6 Cable tray or trough shall be provided with all required fittings for a complete installation. Fittings shall include, but not be limited to: Horizontal and vertical elbows and tees, smooth dropout fittings, end closure plates, fixed (or adjustable) splices as needed for field offsets, reducers, barriers or box connector flanges.
- 2.10.7 Cable tray and trough shall be equivalent to Square "D" Company Series CLA/CLG (ladder tray) or CTA/CTG (trough) as a standard of quality and construction.

2.11 DUCT BANKS

- 2.11.1 Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.
- 2.11.2 All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accord with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.
- 2.11.3 Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.
- 2.11.4 Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.
- 2.11.5 Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.
- 2.11.6 Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made 18" inside the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations

and towel duct bank rebars 4" into manhole wall with grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.

2.11.7 Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

2.12 RACEWAY FITTINGS

2.12.1 Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

2.12.2 Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

2.12.3 Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

2.12.4 Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

2.12.5 Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.12.6 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with $\frac{3}{4}$ " rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

2.12.7 Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

2.12.8 Fittings for E.M.T. conduit shall be of the set-screw type. Fittings for sizes 2" and larger shall have two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.

2.12.9 Indentation or die-cast fittings shall not be permitted in any raceway system.

2.12.10 Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.

2.12.11 All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

2.13 SUPPORTS AND HANGERS

- 2.13.1 Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.
- 2.13.2 No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.
- 2.13.3 Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.
- 2.13.4 The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
- 2.13.5 Individual conduits run on building walls or equipment shall be secured by one hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.
- 2.13.6 Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.
- 2.13.7 Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.
- 2.13.8 Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.
- 2.13.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be ¼ ", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.
- 2.13.10 Welding directly on conduit or fittings is not permitted.
- 2.13.11 Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.
- 2.13.12 Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.
- 2.13.13 Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

2.14 FIRESTOPPING MATERIALS

- 2.14.1 All conduits, and cables penetrating fire rated floors and walls must be firestopped. firestopping assembly must be UL listed. All corridor walls, storage room walls and mechanical room walls are to be considered on hour fire rated. The second floor slab shall also be considered one hour rated.
- 2.14.2 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type. (i.e., one hour fire rated gypsum wall board with insulated metal pipe penetration.)
- 2.14.3 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.
- 2.14.4 The manufacturer of the firestopping materials must provide on site training for the contractor. The training session shall demonstrate to the contractors the proper installation techniques for all the firestopping materials. The training session shall be four hours minimum. Contact the Engineer prior to conducting this training session.
- 2.14.5 Firestopping materials to include but not limited to the following:
- 2.14.5.1 3M fire barrier FS-195 wrap/strip.
- 2.14.5.2 3M fire barrier CP 25 caulk.
- 2.14.5.3 3M fire barrier MP moldable putty.
- 2.14.5.4 3M fire barrier RC-1 restricting collar with steel hose clamp.
- 2.14.5.5 3M fire barrier damming materials.
- 2.14.5.6 3M fire barrier CS-195 composite sheet.
- 2.14.5.7 3M fire barrier fire dam 150 caulk.
- 2.14.5.8 Steel sleeves.

PART 3 – INSTALLATION:

- 3.1 This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Table No. 1, Chapter 9, of the National Electrical Code, unless otherwise shown on the Contract Drawings.
- 3.2 No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 6" from flues or hot water pipes.
- 3.3 All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.
- 3.4 Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with

- explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.
- 3.5 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings.
 - 3.6 Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".
 - 3.7 All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.
 - 3.8 At least one 1 inch and three ¾ inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.
 - 3.9 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.
 - 3.10 Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
 - 3.11 Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.
 - 3.12 Complete installation of electrical raceways before starting installation of cables or wires within raceways.
 - 3.13 All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 42" to top below finished grade, unless otherwise noted on plans.

PART 4 – SPECIALTIES:

- 4.1 All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.
- 4.2 All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.
- 4.3 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.
- 4.4 All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.
- 4.5 Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260544 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 – GENERAL:

- 1.1 Each Electrical Contractor's attention is directed to Section 260500, General Provisions, Electrical and all other contract documents as they may apply to his work.
- 1.2 Each Electrical Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.
- 1.3 Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Phone cable may, at the Contractor's option, and if acceptable to both utility companies, be placed in a common trench with power lines as long as 8" of earth separation is maintained. T.V. cable shall, in all cases, be placed in a separate trench with two feet separation from electrical power lines.
- 1.4 Depths of bury shall be as indicated on the drawings.

PART 2 - SUBSURFACE DATA:

- 2.1 Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Electrical Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made. No claim for extra compensation, or for extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown.
- 2.2 Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

PART 3 - BENCH MARKS AND MONUMENTS:

- 3.1 Maintain carefully all bench marks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

PART 4 – EXCAVATION:

- 4.1 Each Electrical Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.
- 4.2 Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools.
- 4.3 The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.
- 4.4 Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.

- 4.5 In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor.

PART 5 – BACKFILL:

- 5.1 Backfill shall be accomplished with clean debris free earth and the new earth tamped at 12" intervals so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.
- 5.2 Backfill trenches only after conduit and cable have been inspected, tested, and locations of pipe lines have been recorded on "as-built" drawings.
- 5.3 The backfill below paved areas shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill.
- 5.4 The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260553 – IDENTIFICATIONS

PART 1 – GENERAL:

- 1.1 Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with ½ " black lamacoid plate (or equivalent) with white letters ¼ " high.
- 1.2 The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel.
- 1.3 Branch circuit panelboards and switch gear shall be provided with a black lamacoid plastic plate with ½ " white letters for panel designation and ¼ " white letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings.
- 1.4 Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In health care applications, the NEC - designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in ¼" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate.
- 1.5 Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 2 - DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER):

- 2.1 Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.
- 2.2 The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.
- 2.3 Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50NC. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.
- 2.4 Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.
- 2.5 Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on schedules on the plans or as determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- 2.6 Distribution panelboards shall be Square "D", G.E., I.T.E./Siemens or approved equivalent.

PART 3 - BRANCH PANELBOARDS:

- 3.1 This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).
- 3.2 All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.

- 3.3 Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, bolt-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.
- 3.4 Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.
- 3.5 Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.
- 3.6 Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated.
- 3.7 All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards. Provide separate neutral and ground bars.
- 3.8 All circuit breakers used to switch lights shall be SWD (switching duty) rated.
- 3.9 Panels shall be Square "D", G.E., I.T.E./Siemens or approved equivalent.

PART 4 - INSTALLATION INSTRUCTIONS:

- 4.1 Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.
- 4.2 All dust and debris shall be removed from the panels before they are energized and placed in service.
- 4.3 All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

PART 5 - SAFETY SWITCHES:

- 5.1 Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.
- 5.2 All safety switches shall be NEMA Type 1, NEMA 3R, or as required by the operating environment, Heavy Duty Type HD, UL listed.
- 5.3 All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- 5.4 All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- 5.5 Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to

three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

5.6 Switches shall be as manufactured by Square D., G.E., I.T.E./Siemens or approved equivalent.

PART 6 – FUSES:

6.1 Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.

6.1.1 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:

6.1.2 Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

6.2 No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.

6.3 Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

6.4 Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284NF melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

6.5 Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately 125% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

6.6 Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

PART 7 - DISTRIBUTION TRANSFORMERS:

7.1 The Contractor shall provide dry-type transformers as manufactured by Square "D", G.E., Siemens or equivalent. KVA ratings shall be as indicated on the electrical plans.

7.2 Three phase transformers are to have 480 volt Delta primary and 120/208V/30/4W secondary. 30 KVA transformers and larger are to be supplied with 2-2½% full capacity taps above and 4-2½% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.

7.3 Transformers 30 KVA and above shall be Class H, 115°C. and shall have the ability to carry a continuous 15% overload without exceeding a 115°C rise above 40° ambient.

- 7.4 Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.
- 7.5 Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.
- 7.6 All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.
- 7.7 The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.
- 7.8 Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.
- 7.9 The maximum top of case temperature shall not exceed 35°C above ambient.
- 7.10 The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel.
- 7.11 The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.
- 7.12 Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 KVA, 42 D.B. to 150 KVA; 45 D.B., 225 to 300 KVA; 50 D.B. and 500 KVA, 54 D.B.

PART 8 – CONTACTORS:

8.1 General

- 8.1.1 Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically-held) enclosure, unless otherwise noted or required.
- 8.1.2 Contactors shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA Standards. They shall be industrial-duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.
- 8.1.3 Contactors shall have provisions for factory or field addition of:
 - 8.1.3.1 Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
 - 8.1.3.2 Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
 - 8.1.3.3 Control-circuit fuse holder, one or two fuses.

8.1.3.4 0.2-60 second adjustable interval timer attachment, if so indicated on plans.

8.1.3.5 Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.

8.2 Electrically Held Lighting Contactors

8.2.1 Contactor coils shall be continuously rated and encapsulated, 120 volt rated. Enclosures shall be NEMA 12, to minimize noise transmission.

8.3 Mechanically Held Lighting Contactors

8.3.1 Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.

8.3.2 Lighting contactors shall be Square D Class 8903 or equivalent by G.E., I.T.E./Siemens, or Allen-Bradley.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262726 - WIRING DEVICES AND PLATES

PART 1 – GENERAL:

- 1.1 This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.
- 1.2 Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

PART 2 – MATERIALS:

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE - DUPLEX COMMERCIAL GRADE	125V, 20A	NEMA 5-20R	*	HUBBELL CR5362 * GE 5362 *
	125V, 15A	NEMA 5-15R	*	LEVITON 5362 * HUBBELL CR5262 ** GE 5262 ** LEVITON 5262 **
* USE WHEN ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHEN ON DEDICATED 15A CKT., OR WHEN MORE THAN ONE RECEPTACLE ON A CIRCUIT				
RECEPTACLE - DUPLEX PREMIUM GRADE	125V, 20A	NEMA 5-20R	*	HUBBELL 5352 LEVITON 5362 GE 5362,
	125V, 15A	NEMA 5-15R	*	HUBBELL 5252 LEVITON 5262 GE 5262
* USE WHERE ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHERE ON DEDICATED 15A CKT., OR WHERE MORE THAN ONE RECEPTACLE ON A CIRCUIT				
RECEPTACLE - DUPLEX G.F.I.	125V, 20A	NEMA 5-20R	*	HUBBELL GF-5352 GE GF-5342 LEVITON 6898
RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R	*	HUBBELL 5361
RECEPTACLE - DUPLEX, SAFETY TYPE (WITH TAMPER-RESISTANT SCREWS)	125V, 15A	NEMA 5-15R	!	HUBBELL SG-62H - NO SUBSTITUTIONS
RECEPTACLE, DUPLEX NEON PILOT FACE-RED	125V, 15A	NEMA 5-15R	*	HUBBELL 5262-LHR GE 5362-LHR LEVITON 5362-LHR

RECEPTACLE, SIMPLEX WITH CLOCK HANGER TAB, STAINLESS STEEL PLATE	125V, 15A	NEMA 5-15R	METAL	HUBBELL 5235 LEVITON 658-BR ARROW-HART 5760
RECEPTACLE, DUPLEX ISOLATED GROUND (WITH ORANGE LEGEND PLATE)	125V, 20A	NEMA 5-20R	ORANGE	HUBBELL IG-5362 GE 5362-IG LEVITON 5362-IG
RECEPTACLE, DUPLEX HOSPITAL GRADE (TO BE USED IN ALL PATIENT CARE AREAS, PER N.E.C., ART. 517)	125V, 20A	NEMA 5-15R NEMA 5-20R	*	HUBBELL 8200H GE 8200 LEVITON 8200 HUBBELL 8300H GE 8300 LEVITON 8300
RECEPTACLE, DUPLEX RED COLOR NYLON FACE (FOR EMERGENCY POWER OUTLETS, WITH RED PLATE)	125V, 20A	NEMA 5-20R	RED	HUBBELL 5352-RDB GE 5362-RDB LEVITON 5362-RDB
RECEPTACLE, DUPLEX ISOLATED GROUND WITH SURGE SUPPRESSION, INCLUDING INDICATOR LIGHT	125V, 15A	NEMA 5-15R	BLUE DEVICE OR BLUE COVER PLATE	HUBBELL 5250S LEVITON 5380 ARROW-HART 5362
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 GE 4124 LEVITON 5032
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 GE 4139 LEVITON 5372
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 GE 4141 LEVITON 5374
SWITCH, SINGLE POLE	120/277V, 20A	SPST	*	HUBBELL 1221 GE 5951 LEVITON 1221
SWITCH, SINGLE POLE - RED TOGGLE (WITH RED COVER PLATE, FOR EMERGENCY LIGHTING CONTROL)	120/277V, 20A	SPST	RED	HUBBELL 1221-RDB GE 5951-RDB LEVITON 1221-RDB

SWITCH, THREE-WAY	120/277V, 20A	3-WAY	*	HUBBELL 1223 GE 5953 LEVITON 5953
SWITCH, FOUR-WAY	120/277V, 20A	4-WAY	*	HUBBELL 1224 GE 5954 LEVITON 5954
SWITCH, KEYED	120/277V, 20A	SPST	N/A	HUBBELL 1221-L GE 5951-L LEVITON 1221-L
SWITCH, KEYED	120/277V, 20A	3-WAY	N/A	HUBBELL 1223-L GE 5953-L LEVITON 1223-L
SWITCH, KEYED	120/277V, 20A	4-WAY	N/A	HUBBELL 1224-L GE 5954-L LEVITON 1224-L
NOTE:				
SWITCH, KEYED TO <u>EACH</u> BE FURNISHED WITH ONE HUBBELL #1209 KEY. TURN OVER TO OWNER AT CLOSE OF PROJECT AND OBTAIN RECEIPT FOR VERIFICATION THAT KEYS HAVE BEEN DELIVERED.				
SWITCH, MOMENTARY, 3-POSITION, CENTER OFF SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT	*	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, PILOT (TOGGLE LIT IN ON POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPST OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221-PL7 GE EQUIVALENT LEVITON EQUIVALENT
TIMER SWITCH	120V	SPST, 15 MINUTE	*	NUTONE VS63 GE EQUIVALENT LEVITON EQUIVALENT

NOTES:

1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT
2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE
- * SEE ARTICLE 3, COLOR.

2.2 Small Motor Control Switches:

- 2.2.1 For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch without thermal overloads. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures. If the motor to be controlled is not equipped with internal thermal overload protection, overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided.

PART 3 – COLOR:

- 3.1 Color of devices shall be as selected by the architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.
- 3.2 Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.

PART 4 - MANUAL DIMMERS:

- 4.1 Manual dimmers for incandescent, MR-lamp incandescent or fluorescent loads shall be matched to the type load intended to be controlled.
- 4.2 Power rating shall be verified by examining the plans and suitable for the load, but in no case less than circuit load. Furnish dimmers in nominal power ranges of 600W, 1000W and 1500 watts.
- 4.3 Manual dimmers shall be provided with all solid state components, complete with choke coil and/or other R.F.I. suppression devices.
- 4.4 Manual dimmers shall be suitable for mounting in single gang outlet box, ganging together in multi-section boxes where indicated, without derating being necessary.
- 4.5 Manual dimmers shall be the tap-on, tap-off, rotary type, with full range control 0-100%. Hunt Company or equivalent by G.E., Leviton, Hubbell or Lutron.

OR

- 4.6 Manual dimmers shall be of the sliding-type, with detent stop at off position, full range control 0-100%. Lutron Company "Nova" Series or equivalent Lithonia, Lightolier.

- 4.7 Manual dimmers for fluorescent lighting or low voltage transformer-fed incandescent fixtures shall be matched to suit the characteristics of the particular manufacturer's electronic ballast or transformer used in the dimming - type fixture. Submit shop drawings of dimmer in the same submittal as the lighting fixtures.

PART 5 - PLATES AND COVERS:

- 5.1 Unless otherwise specified or noted, all wiring device plates and covers shall be smooth thermoplastic, Hubbell "P" Series or equivalent G.E. or Leviton. Color shall match device unless otherwise indicated.
- 5.2 All kitchen, gymnasium or food service area plates shall be bright finish 302 stainless steel.
- 5.3 Cover plates shall be of one manufacture insofar as possible.
- 5.4 Weatherproof plates for G.F.C.I. receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, cover closed. Vertical mounting - Hubbell WP26, horizontal mounting - Hubbell CWP26H (die-cast zinc) or equivalent Leviton or G.E.
- 5.5 Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E. or Leviton.
- 5.6 Cover plates for computer, telephone or other system outlets shall be as required to meet supplier or the owner's requirements, as applicable. Color to match other plates on project. Furnish telephone plates with wall-mounting studs if mounted at 48" or higher. See devices schedule below.

PART 6 - COMMUNICATIONS DEVICES AND PLATES:

- 6.1 Communications devices and wallplates furnished for this project shall all be standard products, of the same manufacturer. They shall consist of a wallplate bezel, capable of holding snap-in devices as indicated.
- 6.2 Color of communications wallplates shall match the color of all other plates furnished on the project, matching switch, receptacles, etc. Verify all color selections with the Architect.
- 6.3 The color of communications wallplate snap-in inserts shall be as noted herein, or shall be per the owner's standards, if applicable. Verify color requirements prior to ordering any materials.
- 6.4 Provide securely-fastened permanent labels in the faceplate of communications wallplates that clearly and legibly indicate the address or unique identifier for an individual jack.
- 6.5 All communications wallplates shall be provided with a bezel capable of holding a minimum of four separate device inserts, unless otherwise noted. Provide blank inserts to close any unused positions, of a color to match the plate.
- 6.6 Communications wallplates and devices shall be as manufactured by Panduit, Lucent Technologies, Leviton, AMP or approved equivalent.

6.7

DEVICE INSERT SCHEDULE	
Multimode Fiber Optic (Always Install in Pairs)	FDDI - Compatible 62.5/125:, ST-Style Grey Color, Female (2 fibers terminated)
Ethernet Network Data	Category 5, 8 Pos/4 Pair Tan or Beige Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 4 Pair	Category 5, 8 Pos/4 Pair Black Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 4 Pair	Category 3, 8 Pos/4 Wire Black Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 2 Pair	Category 3, 4 Pos/2 Pair Green Color RJ-11 (2 Pairs Terminated)
Video Circuits	"F" Connector Bulkhead Style White Color (RG-6 coax termination)
Blank Cover	Color to Match Wallplate
Wallplate (4-Port/1 Gang)	Color to Match Wiring Devices Used in Adjacent Areas
Special Comm. Port for T-1 and Special Communication Circuits	Orange Color RJ-31X, 8 Pos/4 Pairs Terminated

PART 7 - STANDARD SINGLE-SERVICE FLOOR BOXES:

- 7.1 In general, floor boxes to be used flush in concrete floors shall be of single-gang stamped steel construction, round, deep style, fully adjustable Hubbell B-2537 Series, Type 1 or equivalent.
- 7.2 Where multiple gangs are indicated on the plans (or elsewhere), multi-gang (up to 3 yokes maximum) stamped steel, rectangular, deep style units shall be used. They shall be fully adjustable, Hubbell B-2437 Series, Type 1, or equivalent. Multiple-gang boxes shall be provided with removable partitions between each section in accord with N.E.C., where power and non-power circuits enter the same box.
- 7.3 In general, all cover plates for floor boxes shall be flush, solid brass. Provide typical plates as listed:

- 7.3.1 Duplex Outlet - Round, Duplex Flap - Hubbell S-3925
Rectangular, Duplex Flap - Hubbell S-3825
- 7.3.2 Telephone or Data Round, Combination 1" or 2 1/8" - Hubbell S-2725
Rectangular, Combination 1" or 2 1/8" - Hubbell S-2625
- 7.4 Furnish floor boxes with threaded hubs as required to suit conduit routings, 3/4" minimum.
- 7.5 Furnish carpet flanges for all boxes installed in carpeted areas. Flanges to be clear polycarbonate plastic, round - Hubbell S-3079 or rectangular, for gangs indicated - Hubbell S-308 Series or equivalent.
- 7.6 Floor outlet boxes shall be installed dead level flush with wood, VCT, concrete or other hard surface type floor. Furnish special stop trims for terrazzo where required.
- 7.7 Outlets within floor boxes shall be as specified elsewhere in these specifications.

PART 8 - SPECIAL MULTI-SERVICE FLOOR BOXES:

- 8.1 In general, floor boxes that are to contain multiple services such as power, data, voice, video, etc., shall be constructed of stamped steel and heavy thermoplastic with barriers or compartments to separate power from signal services per National Electrical Code.
- 8.2 Provide multi-service floor boxes with proper trim for carpet, wood, terrazzo, tile or concrete floors, wiring slots, dust covers and proper device plates to hold outlets, jacks, etc. They shall be fully adjustable. Conduit rough-in shall be as required. All tops shall be capable of receiving an insert of the surrounding floor material.
- 8.3 Outlets for multi-service floor boxes shall be as specified elsewhere in these specifications.
- 8.4 Set boxes dead level with flooring and provide proper support by thickening concrete slab, welding angle iron across joists below or other approved means.
- 8.5 Multi-service floor boxes shall be capable of containing a minimum of two duplex receptacles and two 4-position single gang modular plates for voice, video or data jacks and shall be as manufactured by Wiremold/Walker Co., "Resource RFB," with all required accessories or equivalent Hubbell or Lew.

PART 9 - INSTALLATION:

- 9.1 All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.
- 9.2 Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.
- 9.3 Provide G.F.C.I. duplex feed-thru style receptacles where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "G.F.C.I. protected" label on each downstream outlet.

- 9.4 Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.
- 9.5 All receptacles shall be installed with ground prong at **top** position.
- 9.6 All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 262800 –ELECTRICAL SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions, General Mechanical Provisions and Division 1 Specifications Sections, apply to this section.

1.2 MANUFACTURERS

- 1.2.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

Mason Industries
Vibration Eliminator Co., Inc.
Vibration Isolation Co., Inc.

All Seismic restraint devices; isolators, calculations and seismic design shall be provided by a single vibration isolator manufacturer as listed above. All seismic design shall be prepared and stamped by a licensed Professional Engineer in the State of Indiana with a minimum of 5 years experience.

1.3 SUMMARY

- 1.3.1 This Section includes vibration isolators, vibration isolation bases, and seismic restraints and snubbers for mechanical and electrical equipment, duct and piping systems.

Drawings and calculation
Certification of seismic restraint designs
Installation supervision

1.4 PROJECT CONDITIONS

- 1.4.1 Building Classification Category: III

- 1.4.2 Building Importance Factor: 1.5

- 1.4.2.1 Building components with an Ip of 1.5 shall include, but not be limited to, Life Safety components and all components needed for continued operation of the facility. These components shall include but not be limited to fire alarm devices, normal and emergency panel feeds, etc.

- 1.4.3 Seismic Design: C

1.5 APPLICABLE CODES AND STANDARDS

- 1.5.1 The International Building Code; 2002.

1.6 SUBMITTALS

- 1.6.1 Product Data: Indicate types, styles, materials, and finishes for each type of isolator and seismic restraint specified. Include load deflection curves.

1.6.2 Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to the structure and to the supported equipment. Include auxiliary motor slides and rails, and base weights.

1.7 SEISMIC RESTRAINT SUBMITTALS

1.7.1 Shop Drawings: Show designs and calculations, prepared and stamped by a licensed professional engineer, as required for work of this project.

1.7.2 Design Calculations: Calculations for design and selection of seismic restraints for equipment, emergency generators, conduit systems, cabling systems, etc., stamped by a licensed professional engineer.

The following equipment shall be required to have calculations:

- Transformers
- UPS
- Light Fixtures
- Generators
- Large Equipment Enclosures

1.7.3 Analysis must include calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in listed building codes acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.7.4 Seismic Restraint Details: Detail fabrication and attachment of restraints and Snubbers.

1.7.5 Concrete Pad Details: Show required concrete pad size and location for equipment. Show locations of required pad anchors and stud wedge anchors.

1.7.6 Where wall, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for conduit, cable trays, cable rings, etc. must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

1.8 SEISMIC RESTRAINT QUALITY ASSURANCE

1.8.1 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who has a minimum of 5 years experience in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 SEISMIC CONTROLS

2.1.1 Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.

2.1.2 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

2.1.3 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

- 2.1.4 Minimum Additional Travel: 50 percent of the required deflections at rated load.
- 2.1.5 Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- 2.1.6 Finishes: Baked enamel for metal components. Color-code to indicate capacity range.
- 2.1.7 Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges.
- 2.1.8 Manufactured Seismic Snubbers: All-directional, double-acting snubbers
- 2.1.9 Construction: Interlocking steel members restrained by ¾-inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8inch (3mm) clearance in all directions between rigid and resilient surfaces.
- 2.1.10 Fabricated Seismic Snubbers: Welded structural-steel designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.
- 2.1.11 Construction: Welded steel shapes conforming to ASTM A 36 (ASTM A 36M)
- 2.1.12 Resilient Components: ¾ inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert.
- 2.1.13 Flexible Stainless Steel Hose: Hoses shall be installed on equipment side of shut-off valves horizontally and parallel to the equipment shafts wherever possible.
 - 2.1.13.1 Construction: Stainless steel braid and carbon steel fittings.
 - 2.1.13.2 Connection: Less than 3”: Male nipples.

PART 3 - EXECUTION

3.1 INSTALLATION

- 3.1.1 Install and anchor seismic-control products according to manufacturer’s written instructions and authorities having jurisdiction.
- 3.1.2 Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.
- 3.1.3 Filled concrete inertia bases, after installing base frame, with 3000-psig (20.7-Mpa) concrete, and trowel to a smooth, hard finish. Cast-in-place concrete is specified in open parts of the specifications.
- 3.1.4 Isolated conduit, cable trays, etc. as follows (All are required to be braced):
 - 3.1.4.1 Horizontal isolation: The first three hangers in the main lines near the mechanical equipment shall be precompressed spring and neoprene type. Floor supported piping shall rest on spring type isolators. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75” deflection for pipe sizes up to and including 3”, 1 ½” deflection for pipe sizes up to and including 6”, and 2 ½” deflection thereafter.
 - 3.1.4.2 Riser isolation: Risers shall be suspended from spring and neoprene hangers or supported by floor spring isolators, all-directional acoustic pipe anchor, and pipe guide. Steel springs shall be a minimum of 0.75”

except in those expansion locations where additional deflection is required to limit load changes to +25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

3.2 SEISMIC CONTROL

3.2.1 All mechanical and electrical systems are to be seismically restrained. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical (equipment not listed is still included in this specification).

3.2.2 Vibration Isolation Bases: Mount equipment on structural-steel bases or concrete inertia bases as required.

3.2.3 Component Importance Factor is 1.5 for the following Mechanical and Electrical Systems (All other Systems shall have a Component Importance Factor of 1.0):

3.2.3.1 Fire Protection System, and all other complete system components required to operate these systems,

3.2.3.2 Utility and service line at structure interfaces, and all other complete system components required to operate these systems,

3.2.3.3 Interior natural gas piping and gas-fired appliances, and all other complete system components required to operate these systems,

3.2.3.4 Water heaters, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.5 Boilers, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.6 Fluid Cooler, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.7 All lighting systems including fixtures, controls, emergency power, etc.

3.2.3.8 Fire Alarm System.

3.2.3.9 Emergency Power System and all wiring, including branch circuits and feeders.

3.2.3.10 Electrical connections, equipment, etc. associated with all mechanical equipment.

3.2.3.11 Nurse call system.

3.2.3.12 Normal power feeders and branch circuits.

3.2.3.13 Also, the interrelationship of components and their effect on each other shall be considered so that the failure of any essential or non-essential architectural, mechanical or electrical component shall not cause the failure of another essential architectural, mechanical or electrical component.

3.2.4 Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubber as close as possible to the vibration isolators and bolt to supporting structure.

3.2.5 Manufacturer shall provide installation instructions, drawings and trained field supervision to insure proper installation and performance. Visit the project site before installation is begun and instruct installers in

correct installation procedures for vibration isolation, seismic restraints and concrete pads. Observe installation of other work related to vibration isolation and seismic work, including concrete pad installations; and, after completion of other related work (but before equipment startup), shall furnish written report to Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover the following:

- 3.2.5.1 Equipment installations (performed as work of other sections) on vibration isolators and Seismic restraints.
- 3.2.5.2 Conduit connections including flexible connections.
- 3.2.5.3 Passage of conduit and cable trays which is to be isolated through walls and floors.
- 3.2.6 Do not start-up equipment until inadequacies have been corrected in manner acceptable to Vibration Isolator and Seismic Controls Manufacturer.
- 3.2.7 Spacing for restraints shall be as follows, except where lesser spacing is required to limit anchorage loads:
 - 3.2.7.1 Ductwork and electrical services (conduit, bus ducts, cable trays, and ladder trays) transverse restraints shall occur at 30' intervals (or at both ends of the duct run if less than specified interval) and longitudinal restraints shall occur at 60' intervals (with at least one restraint per duct run). Transverse restraints shall be installed at each duct/electrical services turn and at each end of a duct/electrical run.

END OF SECTION

DIVISION 26 - ELECTRICAL

SECTION 265113 - LIGHTING FIXTURES AND LAMPS

PART 1 – GENERAL:

- 1.1 Furnish and install all lighting fixtures, as herein specified, complete with lamps and accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.
- 1.2 All items furnished shall comply with the latest standards applicable such as U.L., NEMA, etc., and shall bear labels accordingly. All fixtures shall be the color specified or as selected by the Architect. Wherever fixtures have evident damage, they shall be restored to new condition or shall be replaced. Likewise, fixtures showing dirt, dust or finger prints shall be restored to new condition or shall be replaced.
- 1.3 Eight copies of light fixture factory shop drawings and cuts, showing fixture dimensions, photometric data, installation data and, if applicable, air handling data, shall be submitted to the Engineer for written approval 30 days after bid date. (Verify shop drawing quantities with the Architect.)
- 1.4 Locate pendant, surface mounted or chain-hung industrial fixtures in mechanical rooms and similar spaces to avoid ductwork and piping. Locate around and between equipment to maximize the available light. Request a layout from the Engineer if uncertain about an installation.
- 1.5 Alternate fixtures may be substituted for types specified by name or catalog number. Proposed substitutions must be submitted to the Engineer ten working days prior to bid date for written approval to bid. This written approval will only be issued in addendum form.
- 1.6 Where emergency battery packs are provided with fixtures (if any), they shall be connected to an unswitched power line and wired in accord with the manufacturer's recommendations.
- 1.7 All reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting Alzak cones and specular reflectors shall be handled with care during installation or lamping to avoid fingerprints or dirt deposits. It is preferred that louvers be shipped and installed with clear plastic bags to protect louvers. At close of project, and after construction air filters are changed, remove bags. Any louver or cone showing dirt or fingerprints shall be cleaned with solvent recommended by the manufacturer to a like-new condition, or replaced as necessary in order to turn over to the Owner new fixtures at beneficial occupancy.
- 1.8 Where fixtures are scheduled to be provided with quartz restrike relay and lamp, for auxiliary or emergency illumination, the controlling relay shall be configured to energize the lamp on cold start or hot lamp restrike.
- 1.9 Refer to architectural details as applicable for recessed soffit fluorescent fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.

PART 2 – VOLTAGE:

- 2.1 All lighting fixtures will be rated 120, 277 or 480 volts, single phase as indicated or required.

PART 3 – BALLASTS:

3.1 Electronic Ballast Specification

- 3.1.1 Fluorescent ballast to be high performance electronic to operate at a frequency of 20KHz or higher with less than 2% lamp flicker, at an input voltage of 108 to 132 VAC (120 volt line) or 249 to 305 VAC (277 volt line) at an input frequency of 60 Hz minimum of .88 ballast factor, power factor of .98. Light output to remain constant for line voltage of $\pm 4\%$. Ballast to comply with EMI and RFI limits set by FCC (CFR 47 part 18) for normal electrical equipment and have less than 1.4 lamp current crest factor (or less if required by the fluorescent lamp supplier). Verify this prior to submitting shop drawings. Ballast to meet ANSI Standard 82.41 and be UL listed Class P Type I. Ballast shall be non-PCB bearing.
- 3.1.2 Ballast to have less than 10% total harmonic distortion with less than 6% third harmonic distortion. Ballast to have "A" sound rating with a power factor greater than .99 and have a twenty year rated life. Ballasts used shall operate 1, 2, 3, or 4 T8 lamps as specified in the fixture specification. Use a 2, 3 or 4-lamp ballast to match number of lamps in fixture, and meet all switching requirements as shown on the drawings. Ballasts shall be unconditionally warranted by the manufacturer for a period of three years from project beneficial occupancy.
- 3.1.3 Motorola, Advance, Universal or Valmont are acceptable manufacturers.
- 3.1.4 **NOTE:** No single can-4 lamp ballast with 2 source input will be allowed for any fixture(s) shown supplied by both normal and emergency power.
- 3.1.5 Provide in-line fuse-holder(s), with fuse sized per manufacturer's recommendations for each 277 volt fixture.
- 3.2 Metallic vapor lamp (H.I.D.) ballast shall be rated 120 or 277 or 480 volts, 60 Hertz energy-saving high power factor, copper wound, auto regulator type for single lamp, complete with external fuse holder (Bussmann HLR) and as manufactured by Jefferson, G.E., or Advance. All vapor lamp ballasts shall be encapsulated or potted to minimize the amount of audible hum produced. No open core and coil ballasts shall be provided unless specifically indicated in the fixture description. Ballast factor for all H.I.D. ballasts shall be $1.0 \pm 5\%$ tolerance. Ballast shall deliver full wattage, to match the rating of the lamp, assuming proper input voltage, within the tolerance range noted.
- 3.3 Where lighting standards have fuses protecting ballasts, an in-line type of fuseholder shall be located at the base of the pole, readily accessible behind the handhole coverplate. Where multiple circuited luminaires are on a single pole, identify the separate fuseholders.

PART 4 – LAMPS:

- 4.1 Lamps furnished and installed in indicated fixtures shall be as manufactured by G.E., Westinghouse, Phillips, Osram or Venture. Wherever possible, all lamps provided shall be manufactured in the United States of America.
- 4.2 All incandescent lamps shall be rated 130 volts with a medium screw type base (or as required) in wattages less than 300 watts and 130 volts, mogul screw type base in 300 watts and larger.
- 4.3 Fluorescent lamp to be T8 (one inch diameter), various lengths, wattages, rapid start with lamp efficacies of over 97 lumens per watt on electronic ballast, 91 lumens per watt on magnetic ballast, with a color rendering index (C.R.I.) of 65 or higher, medium bi-pin base configuration. Normal color to be 4100N Kelvin unless specified otherwise in fixture list. Normal power input to be 32 watts for 48" lamps. Lamps

- to have an average life of 15,000 hours at three hours per start. Lamps to operate at 265MA. Osram, Westinghouse, Philips, and General Electric are acceptable manufacturers.
- 4.4 H.I.D. (low or high pressure sodium, mercury vapor, metal halide) lamps shall be suitable for the specified fixture, and as listed in the fixture schedule. All HID lamps shall be furnished with mogul base, unless otherwise noted or required. H.I.D. lamps used in outdoor fixtures shall have clear envelopes, in indoor fixtures they shall have diffuse coatings unless specifically indicated otherwise.
 - 4.5 Metal halide lamps shall be Osram "Super Metalarc" 4100E Kelvin correlated color and temperature (C.C.T.). Where used in horizontal burning positions, provide with position indicators on base. Consequently, all fixtures specified with horizontal metal halide lamps shall utilize position-oriented sockets, and lamps shall be installed per manufacturer's recommendations. No substitutions are permitted for this brand of metal halide lamp, where indicated for horizontal burning position. All metal halide lamps in any given area shall be the same color temperature rating and C.R.I. Clear lamps shall be 60 C.R.I. minimum, coated lamps shall be 70 C.R.I. minimum.
 - 4.6 Where a fixture containing an HID lamp utilizes a variable - focus or positioning socket, it shall be adjusted for the distribution pattern indicated.
 - 4.7 "MR" incandescent lamps shall be 12 volt rated, with appropriate transformer for an eleven volt secondary voltage or as recommended by the lamp manufacturer, with matching dimmer where dimmers are indicated, rated specifically for the lamp/transformer combination. Where M.R. incandescent lamps are indicated to be furnished for line voltages, they shall be rated 130 volts.
 - 4.8 Compact fluorescent lamps shall be Phillips "PL", G.E. "Biax" or Osram. All compact fluorescent lamp/ballast combinations shall be rated for high power factor. No low power factor lamp/ballast combinations may be used.

PART 5 - LIGHT FIXTURE GENERAL REQUIREMENTS:

- 5.1 Fluorescent Recessed Lighting Fixtures - General Requirements
 - 5.1.1 The following are minimum requirements for recessed fluorescent fixtures for lay-in grid, gypsum board, plaster and concealed spline ceilings. Surface-mounted fluorescent fixture requirements shall be similar.
 - 5.1.2 Housings shall be a minimum of 4" depth, premium grade, constructed of a minimum 22 gauge die embossed or stiffened cold rolled pre-treated rust-resistant steel. Troffers shall be equivalent to Hubbell "Versaline," Daybrite "Designer," Lightolier equivalent or Lithonia "2SPG" series.
 - 5.1.3 All parts shall be finished with polyester powder or white baked enamel (85% minimum reflectance) painted after fabrication. All wiring shall be type TFN, or THWN and shall be covered by the steel ballast cover, wiring channel, or socket track. Exposed wiring is not acceptable. Connection wiring shall be accessible thru a hinged access plate above ballast channel in top of unit.
 - 5.1.4 As an option, lay-in troffers may be fitted with preterminated connectors for use with UL listed flexible wiring systems. If this wiring system is proposed by the Contractor, shop drawings shall be submitted and the actual installation drawings shall be included in the project operation and maintenance manuals. Any flexible wiring system proposed shall be approved and acceptable to the lighting fixture manufacturers of the types to be connected.
 - 5.1.5 Ballasts shall be as specified. If a manufacturer and series number is listed, substitution by other manufacturers shall be of the exact same specification (sound rating, energy consumption, life expectancy, warranties, physical size, heat and temperature ratings), etc. All ballasts shall be cool operating, of the electronic energy-saving type, UL and CBM listed.

- 5.1.6 The complete light fixture unit shall be UL listed and labeled. Other agency listings may be acceptable with written approval from the Engineer.
- 5.1.7 Fixture lens doors shall be reversible, hinged, painted after fabrication, with spring-loaded or other mechanically stable positive action latches.
- 5.1.8 Lens shall be as specified for each fixture type. If a specific manufacturer and series number of lens is listed, the substitute shall be of the exact specification (thickness, prism configurations, transparency, efficiency, photometric distribution, hardness, vandal-resistance, etc.). Minimum average thickness of any prismatic lens shall be .125".
- 5.1.9 Fixture trim and/or flanges shall conform with ceiling constructions as required. Verify all types prior to submission of shop drawings and indicate any special types on submittals. Fixtures installed in drywall or plaster ceilings to be provided with flange, screed and swing gate anchoring system.
- 5.1.10 All fixtures shall be furnished with hold down clips to meet applicable seismic codes, four clips per fixture minimum or the equivalent thereof in the installation trim. Verify thickness of drywall or plaster ceilings prior to submission of shop drawings, to allow for proper trim adjustment.
- 5.1.11 Support fixtures with one hanger wire at each end. Hanger wires shall be installed within 15° of plumb, maximum or additional support shall be provided. Wires shall be attached to the fixture body and to the building structure - not to the supports of other work or equipment.
- 5.1.12 Each type of fluorescent (or other type) lay-in fixture shall be furnished with the proper housing flange or lip to suit the type of lay-in grid(s) being utilized on the project. The Contractor is to verify if narrow or standard grid members are being furnished and provide the proper type of light fixture trim. Indicate any special trims on shop drawing submittals.
- 5.1.13 Lamps shall be as specified in lamp section of these specifications, and suitable for use in the fixture intended. If the lighting fixture manufacturer requires a specific lamp for optimum performance, that lamp shall be furnished.
- 5.1.14 Do not provide pressure-lock or any other type of lampholder unless specifically indicated to the contrary or required by local codes. Fixtures may be shipped from the factory with lamps installed, at the Contractor's option.
- 5.2 Industrial and Striplight Fluorescent Fixtures - General Requirements
 - 5.2.1 Units shall have die-formed heavy gauge cold rolled steel channels and die-embossed reflectors.
 - 5.2.2 Finishes to be coated with a gloss powder paint or baked enamel finish with a minimum 85% reflectance.
 - 5.2.3 Units to have aligner clips where required for a continuous row appearance. Where continuous rows exceed twelve feet in length, provide a "unistrut" channel or similarly adequate mounting to stiffen and align row.
 - 5.2.4 Units to have captive latches for ballast covers, heavy-duty lampholders and wire guards where specified. Wire guards shall be heavy-duty #14 wire gauge) minimum with corrosion-resistant plated or vinyl finish.
 - 5.2.5 Ballasts to be as specified herein.
 - 5.2.5.1 Units to be UL listed.
 - 5.2.5.2 Mounting brackets and hanging mechanisms shall be as specified in fixture descriptions, or as required. Allow a generous safety margin with all support systems, as recommended by the manufacturer.

5.3 Recessed Ellipsoidal or Parabolic Cone Downlight - General Requirements

- 5.3.1 Fixture to have an extruded or die-cast aluminum lampholder housing. Retaining mechanism shall provide easy access to lamp and ballast junction box. Lamp holders shall be U.L. listed, compatible with the lamp type specified. All sockets shall be porcelain or high temperature plastic. No bakelite or fiber material shall be used.
- 5.3.2 Unit to have a corrosion-resistant steel junction box with hinged access covers and thermal protector.
- 5.3.3 Mounting/plaster frame to be heavy gauge steel with finishing trim friction support springs, for the required ceiling thickness. Trim to be of color as selected by the Architect.
- 5.3.4 Optical system to consist of a specular clear Alzak upper ellipsoidal (or parabolic, as noted) reflector with specular Alzak cone or microgroove matte black baffle as noted in schedule. Units shall have a UL approved clear tempered glass protection lens where used with metal halide or quartz lamp. Where other than clear Alzak cone/reflector color is noted on the schedule, it shall be furnished as specified.
- 5.3.5 Ballast to be HPF CWA 120 or 277 volt. Fixture to have a prewired, encased and potted ballast tray module. Ballast to be lowest sound rating available for the class and wattage of lamp.
- 5.3.6 Provide telescoping channel bar hangers that adjust vertically and horizontally.
- 5.3.7 Minimum flange shall match cone finish or provide painted color as selected by the Architect on black microgroove baffle types.
- 5.3.8 Lamps shall be as specified in lamp section of these specifications.
- 5.3.9 Fixtures to be UL listed for thru-branch circuit wiring, recessed, and damp locations. Where installed in plaster or drywall or other inaccessible ceiling type, they shall be U.L. listed for bottom access.
- 5.3.10 Refer to other sections of this specification for quartz restrike option requirements.

5.4 Exit Lights - General Requirements

- 5.4.1 Housings and canopies shall be die-cast aluminum or corrosion resistant steel. Mountings shall be wall or ceiling, universal type, to suit the installation conditions.
- 5.4.2 Provide with stencil face, lettering color red, of sizes in accord with code, or as otherwise specified.
- 5.4.3 Provide single or double face as scheduled, indicated on plans or as required by the local authority having jurisdiction. Adjust installation position if required for clear visibility, in accord with applicable codes.
- 5.4.4 Complete unit to be finished in color as selected by the Architect.
- 5.4.5 Provide directional arrows as indicated on plans, as scheduled to suit the means of egress or as required by the local authority having jurisdiction.
- 5.4.6 Lamps shall be long-life type, as specified.
- 5.4.7 Where emergency backup battery packs are provided with exit lights, they shall have capacities for continuous operation per applicable codes. They shall have reserve battery capacity to operate remote lamps where indicated.

5.5 H.I.D. Lighting Fixtures - General Requirements

- 5.5.1 For recessed indoor/outdoor fixtures, housing to be maximum of 20" high, constructed of 22 gauge die-formed, cold rolled steel finished with polyester powder (85% gloss, 89% reflectance) or baked enamel paint. Unit to be painted after fabrication.
- 5.5.2 Surface-mounted indoor or outdoor fixtures shall have aluminum or steel housings as specified, finish or color as selected, wet or damp location U.L. listing as required and full gasketing to prevent insect entry. Provide charcoal or equivalent filter to allow fixture optical assembly to "breathe" for totally enclosed, gasketed fixtures.
- 5.5.3 All wiring to be Type TFN or THWN; all wiring shall be enclosed by ballast covers, flexible conduits, or socket enclosure.
- 5.5.4 Fixtures to have vertical lamp and extruded or die-cast aluminum heat dissipating finned socket housing. Socket shall be porcelain, with lamp shell to be nickel-plated, split type, 4 or 5 KV pulse rating, per U.L. Standards.
- 5.5.5 Where fixtures are scheduled to have metal halide lamps, provide with clear tempered glass shield below lamp.
- 5.5.6 Provide fixtures with high power factor constant wattage auto-transformer (CWA) 120, 277 or 480 volt (as specified or required) ballast, solidly anchored on hinged plate or power drawer that is easily accessible from below fixture. Provide ballast with single or double fusing as needed. Ballasts shall be encapsulated type, lowest available sound rating for the class and wattage of lamp specified. Also see Part 3 above for additional requirements.
- 5.5.7 Provide trim for lay-in, plaster, drywall, etc. applications as needed for recessed fixture.
- 5.5.8 Lamps shall be as specified elsewhere in this section.
- 5.5.9 Refer to other sections of this specification for quartz restrike option requirements.

PART 6 - LIGHTING FIXTURE SCHEDULE:

- 6.1 Note: Each vendor proposing to bid the materials specified herein below is cautioned to review all requirements of the Contract Documents, as they may apply to the work involved, particularly Specifications Section 265113 - Articles 1 thru 5. The general materials requirements are to be met in their entirety by the contractors and vendors supplying these materials. Note: Unless otherwise noted, all 48" dimension fixtures shall be provided with 48" T8 32 watt 2900 lumen 4100°K C.C.T. lamps, quantity as specified, with companion 2, 3 or 4 lamp electronic ballasts. Where fixtures with ballasts have switches that controls lamps individually or in groups, the proper number of separate ballasts shall be provided. Refer to the drawings for specific control information.

6.2 TYPE DESCRIPTION

Refer to drawings for schedule

PART 7 – PHOTOCELLS:

- 7.1 Provide 120, 277 or 480 volt (rated as needed), 1000 or 2000 watt photocells as needed for control of certain circuits or fixtures as indicated on plans. They shall be as manufactured by Tork, Paragon, AMF or approved equivalent.
- 7.2 Mount photocells in locations concealed from sight lines standing on ground unless otherwise noted, in which case the final position shall be as directed by the Architect. Group together (if indicated at one location) and mount on back of parapet wall or otherwise properly support with mounting bracket. Coordinate with roofing installer to ensure that roof penetrations are properly made without violating or reducing the roof warranty in any way. Photocells may be mounted in other locations if it is not practical to install them on roofs or parapets, in which case the Contractor shall request direction for their mounting locations from the Engineer or Architect. Photocells shall always be mounted in a weatherproof, inconspicuous manner.

PART 8 – TIMECLOCKS:

- 8.1 Provide synchronous motor-driven or quartz-digitally based timeclock(s) to control the indicated loads. The number of poles, their ampacity and voltage withstand shall be to suit the load, but in no case less than 30 amps, 277 volts.
- 8.2 Timeclock coil and motor power shall be 120 volts AC, backed up with seven day spring winder (or the electronic equivalent) which is automatically replenished in normal operation. Provide a 120 volt control circuit from the nearest available panelboard. If quartz-based timeclocks are used, they shall have a lithium or rechargeable battery backup to prevent memory loss.
- 8.3 Provide with an astronomical dial, set up and calibrated for the week and month the timeclock is placed in operation. Order unit for the proper geographical latitude for the project site. Digital timeclocks may be substituted for the electro-mechanical type, assuming they meet the same requirements. Also provide day light savings time option and calibrate for April-October dates. Provide instruction to the Owner's representative in proper setting and operation of each type of timeclock provided.
- 8.4 Enclosures for timeclocks shall be surface type, NEMA 1 or NEMA 3R as needed. Where exposed in finished areas, provide flush-style NEMA 1 enclosures.

END OF SECTION.

SECTION 311000 - SITE CLEARING

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 the following:
 - 1. Protecting existing trees to remain.
 - 2. Clearing and grubbing.
 - 3. Stripping and stockpiling topsoil.
 - 4. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
 - 2. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
 - 3. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
 - 4. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 - 5. Division 23 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Engineer.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 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, according to requirements of authorities having jurisdiction and sediment and erosion control Drawings.
- 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.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
 - 1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Engineer.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Chip removed tree branches and stockpile in areas approved by Engineer.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Dispose of excess topsoil as specified for waste material disposal.
 - 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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 the following:
 - 1. Preparing subgrades for slabs-on-grade walks pavements lawns and grasses.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Subbase and base course for asphalt paving.
 - 6. Surface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling for utility trenches.
 - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities.
- B. Related sections include the following:
 - 1. Division 01 section "Special Instructions" for testing and inspections associated with earthwork below building slab and within 5 feet of the building footprint.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material[3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by City Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify City Representative not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without City Representative written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: 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 (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: 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 (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

- H. Drainage Course: 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 (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. 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 (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
 - 4. Tear Strength: 56 lbf ; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf ; ASTM D 4833.
 - 6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf ; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
 - 4. Tear Strength: 90 lbf ; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf ; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock and/or unsatisfactory soils to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 Inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - a. Follow Floor Slab recommendations in geotechnical report, and utilize geogrid for fill that fails proof roll testing.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches (300 mm) each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 - 1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify w City Representative when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by City Representative without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

- D. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the utility pipe or conduit.
- E. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under slabs, use engineered fill.
 - 4. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under slabs, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from fountain and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Walks: Plus or minus 1 inch (25 mm).
 3. Pavements: Plus or minus 1/4 inch (13 mm).

3.16 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 1. Place base course material over subbase course under hot-mix asphalt pavement.
 2. Shape subbase and base course to required crown elevations and cross-slope grades.
 3. Place subbase and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
 4. Place subbase and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: The General Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing, except where "Special Inspections" are required by Chapter 17 of the Kentucky Building Code.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.

- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2500 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by City Representative.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 313116 - TERMITE CONTROL

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. Soil treatment with termiticide at Support Building.
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For termite control products, from manufacturer.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain termite control products from single source[from single manufacturer].

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
 - d. Syngenta; Demon TC, Prelude, Probuild TC.
 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 321313 - CONCRETE PAVING

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 exterior cement concrete pavement for the following:
 - 1. Curbs and gutters.
 - 2. Walkways.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
1. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
1. Aggregate Sizes: 3/4 to 1 inch (19 to 25 mm) nominal.
- D. Water: ASTM C 94/C 94M.
- E. Air-Entraining Admixture: ASTM C 260.

- F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 4500 psi (31 MPa).
 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and 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 exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

2. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet (15.25 m), unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: 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:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a [1/4-inch (6-mm)] [3/8-inch (10-mm)] radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. 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.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. 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 reinforcement, dowels, and joint devices.

- I. 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.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Engineer.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 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 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water 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.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true

planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Finish: To match existing walks.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch (6 mm).
 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 3. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm).
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).

8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 30 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. 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 as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321818 – SYNTHETIC TURF ATHLETIC FIELD (BASE BID)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, tools and equipment necessary to install, in place, all synthetic turf as indicated on the plans and as specified herein, including all related materials not specified under another section but required for the work, whether or not specifically referred to herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's written installation instruction, and in accordance with all approved shop drawings.
2. All submittals must include a cover letter stating any conflict with the specifications listed in this section (Section 321818). If there are items within these specifications that the submitting party does not or cannot comply with, these must be included within said cover letter.

B. Related Sections:

1. Division 31 Section "Earth Moving"
2. Division 32 Section "Concrete Paving"
3. Division 33 Section "Storm Drainage"

1.3 PERFORMANCE REQUIREMENTS

- A. Synthetic turf athletic field shall be capable of continuously draining rainfall at a rate of 2" per hour and 24" of total rain in any 12-hour period.

1.4 SUBMITTALS

A. Submit the following with proposal on BID Day.

1. The turf contractor shall specify in writing that the turf system proposed for installation does not violate any other manufacturer's patents, allowed patents, or pending patents. The turf contractor shall provide documentation indemnifying the owner, architect, construction manager and engineer from any legal action arising from said patent disputes. This document shall be SIGNED AND NOTARIZED by the turf contractor.
2. Synthetic Turf – One sample, approximately 12" X 12", filled. The turf contractor is to provide color samples of the following:
 - a. Standard Green Blend
3. Sand / Rubber mix with proper mix ratio – One sample
4. Quality assurance information as delineated in paragraphs 1.5A, 1.5B, 1.5C, and 1.5D below.

5. The turf contractor must provide a list of at least twenty (20) existing installations, including Owner representative and telephone number, attesting compliance with quality assurance information. Ten (10) of the existing installations must be within 50 miles of the project site.
6. The base contractor (if different from the turf contractor employees) must provide a list of synthetic turf bases completed within the last 2 years, including an owner representative.
7. Yarn manufacturer specification sheet of the proposed pile fiber to be used within the system.
8. Testing by a 3rd party independent laboratory to be submitted showing yarn wear using a lisport machine after a minimum of 40,000 cycles.
9. Turf contractor's specification sheet for proposed turf system to be used on the fields.
10. A sample of the warranty and third party insurance certificate, noting any exceptions to the warranty information listed in the warranty section of this specification.

B. Prior to order of materials, the Contractor shall submit the following:

1. Seam layout of the field and striping plans
2. Details on construction, especially any details that may deviate from these plans and specifications.
3. Shop Drawings
 - a. Shop drawings shall be prepared at the scale of the construction documents and contain all pertinent information regarding installation. These drawings shall be submitted to the Owner for approval prior to the manufacturing and shipment of materials.
 - b. Submit drawings for:
 - I. Seaming plan.
 - II. Installation details; edge details, methods of attachment, other inserts, etc.
 - III. Striping plan; layouts showing any field lines, markings and boundaries, and field logos per project drawings. Include exact line colors, line widths, and tic mark colors/size proposed for each sport.
4. Turf 'rag' samples illustrating details of product, range at tuft, pile height, perforations, and color selections.
5. Signed Certification Letter from the contractor stating that the products to be installed match what was submitted as part of items 1.4.A.7-9.

C. Prior to the beginning of installation, the manufacturer/installer of the synthetic turf shall inspect the subbase and supply a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic playing surface.

D. Prior to Final Acceptance, the Contractor shall submit the following:

1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.
 - a. Provide descriptions of all equipment recommended for maintenance and repair, including both equipment provided by the Contractor, and by the owner.
2. Necessary testing data that the finished field meets the required shock attenuation, as per ASTM F1936.

3. For the carpet installed, submit certified copies of independent (third –party) laboratory reports on ASTM tests as follows:
 - Pile Height, Face Weight & Total Fabric Weight – ASTM D418
 - Primary & Secondary Backing Weights – ASTM D418
 - Tuft Bind – ASTM D1335
 - Grab Tear Strength – ASTM D1682
 - Dynamic Cushion Test – ASTM F-355, Procedure A (system)

1.5 QUALITY ASSURANCE

A. Contractor/Installer’s Experience:

1. The synthetic turf installer shall have the experience of at least forty (40) acceptable full field installations within 100 miles of the project.
2. The Contractor/installer preparing the sub-base material including but not limited to; geo-fabric, gravel base, field drainage and finishing stone shall be covered by the single source 3rd party insurance policy provided to the owner.
3. The Contractor/installer shall employ only qualified, experienced supervisors and technicians skilled in the installation of this specific type of synthetic grass system.
4. The Contractor/installer shall have been continuously in business, under the same name, for at least the past twenty-five (25) years.
5. The Contractor/installer of the gravel base and drainage, if different than the turf contractor, shall have been in the sports field construction and/or synthetic turf installation business, under the same ownership, for at least five (5) years and have installed a minimum of ten (10) full size field base installations.
6. The Contractor/installer shall have an ASBA, American Sports Builders Association, Certified Field Builder (CFB) on staff and be a member of the Synthetic Turf Council (STC).
7. The Contractor/installer must be experienced in installations of synthetic grass products from the same manufacturer and product specified and proposed for this project.

B. Contractor must meet the following criteria:

1. Have proper Contractor’s license, in good standing, and have never had a license revoked.
2. Must not be engaged in any ACTIVE lawsuit. If so, provide explanation of each said occurrence. This must be part of the cover letter required with bid submittal.
3. Have not had a Surety or Bonding company finish work on any contract within the last ten (10) years.
4. Have not been disqualified or barred from performing work for any public Owner or other contracting entity.
5. No current litigation for unacceptable work or non-completion of work.

C. Warranty:

The Contractor shall submit its Manufacturer’s Warranty that guarantees the usability and playability of the full synthetic turf system for its intended uses for an eight (8) year period commencing with the date of Substantial Completion, against all defects in workmanship of the drainage, gravel foundation base and turf surface. The warranty coverage shall not be limited to the amount of the usage.

1. The warranty submitted must have the following characteristics:
 - a. Must provide full system coverage for eight (8) years from the date of Substantial Completion.
 - b. Must warrant materials and workmanship, including but not limited to gravel base stability, drainage rates, seaming materials and adhesives. The warranty shall cover the entire system installation from the turf surface down to the compacted subgrade.
 - c. Must warrant that the finished and accepted playing field elevation shall not vary by more than 0.1' due to instability of the gravel foundation (unrelated to existing, pre-developed subgrade soil conditions) or drainage system and that the field drainage rates will remain at or above design capacity for the life of the warranty.
 - d. Must have a provision to either make a cash refund or repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
 - e. Must be a warranty from a single source covering workmanship and all self-manufactured or procured materials for full turf system.
 - f. Turf contractor must guarantee a 48-hour response time to the owner from initial notice from the owner. If no action is taken within 48 hours, owner must notify turf contractor in writing. In the event the turf contractor does not respond to the owner's written notice within five (5) working days of receipt of the notice or does not submit, schedule and commence corrective work within thirty (30) calendar days (weather permitting) following owner's notification, the owner has the option of having the work performed by others at the expense of the turf contractor. The owner must provide to the turf contractor within seven (7) days a notice in the form of a certified letter, notifying the turf contractor of the end of the thirty (30) remediation period and their intent to use another contractor to perform the work rising from their claim.
 - g. The warranty provided by the turf contractor must be pre-paid, non-cancelable, non-deductible third party insurance policy underwritten by a Best A rated carrier for a single occurrence limit of \$5,000,000 and annual aggregate of \$15,000,000. The policy must cover both the base work and surface installation.
 - h. Warrant that the yarn used to make the grass-like tufts will maintain its UV stability and tensile strength such that the strength of the fiber when measured in accordance with ASTM D-2256 will not decrease by more than 50% during the warranty period due to breakdown of UV stability.
 - i. If original installation contractor is selected to furnish /install replacement turf in the future, drainage and gravel foundation base warranty shall be renewed and carry same warranty as new turf surface warranty.

D. Manufacturer Qualifications

1. Must specialize in manufacturing products specified in this section.
2. Must be experienced in the manufacture of this specific type of infilled synthetic grass system. This includes the tuft fiber, backing(s), and backing coating.
3. Shall have manufactured (tufted) more than fifteen million (15,000,000) square feet of polyethylene tufted turf for sports field use in the past five (5) years.
4. The manufacturer must be a certified member of the Synthetic Turf Council (STC).

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to the site in wrapped, unopened condition.

- B. Store products in safe, clean location and in a manor to protect from accidental damage

1.7 EXISTING CONDITONS

- A. The contractor shall review and accept prior to bidding. The contractor shall review and accept existing conditions prior to beginning the installation.

1.8 LAYOUT

- A. See Drawings for layout. Contractor shall verify all measurements and submit full field layout as a dimensioned drawing with all proposed graphics included, for owner review/approval.

1.9 TEMPORARY UTILITIES

- A. Contractor may connect to the school's existing utilities, as available, to supply necessary water, adequate lighting and electricity for installation. Meters shall be installed by contractor to measure all temporary utility use. Owner will read meters, and contractor will be responsible for paying owner for all utility costs.
- B. Contractor shall supply temporary sanitation facilities, including paying all costs associated therewith.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: The synthetic turf system with a rubber and sand mixture (70% rubber, 30% sand by volume) will be based on The Motz Group's 24/7 40 oz. PolytexUSA Wearmaxx slit filament yarn. Pre-approved Infilled Synthetic Turf System manufacturers and products:
 - 1. The Motz Group
3607 Church Street, Suite 300
Cincinnati, Ohio 45244
Phone (513) 533-6452
 - 2. FieldTurf
5886 Edgehill Drive
Parma Heights, Ohio 44130
- B. Other Manufacturers: Approved manufacturers will be allowed only if requested in writing, meet the specifications of the Basis of Design, and approved by the Owner, in writing. Any request for substitute turf system products must be submitted as a Bidder's question. All support information and specification requirement documentation must be provided as a part of the Bidder's question. If a bidder include another, non-approved manufacturer without submitting a Bidder's question, Bid will be considered "non-responsive".

2.2 MATERIALS

- A. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, should be able to withstand full climatic exposure in the area of the project, be resistant to insect infestation, rot, fungus and

mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow-through drainage, allowing free movement of surface run-off through turf where such water may flow to the existing subbase and into the field drainage system.

- B. The finished playing surface shall appear as mowed grass with no irregularities or wrinkles and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use. The system shall be ideal for baseball, football, soccer, intramurals and recreational use.

C. Synthetic Turf:

- a. Tufted, slit film polyethylene grass-like fabric coated with a urethane secondary backing. The fiber shall be tufted to a finished pile height of not less than 2.125". Tufting gauge shall be no greater than 0.5".
- b. All turf contractors must supply PolytexUSA or Tencate yarn. No other slit film yarn will be accepted.
- c. Pile Yarn (Polypropylene yarn with resistance to fibrillation – LSR yarn is prohibited): Proven athletic caliber yarn designed specifically for outdoor use and stabilized to resist the effect of ultraviolet degradation, heat, foot traffic, water and airborne pollutants. The pile fiber, shall possess the following physical characteristics:

a.	Yarn Denier:	8,000 (nominal)
b.	Breaking Load:	Min. 30 psi
c.	Elongation to Break:	>9%
d.	Moisture Regain	<0.5%
e.	Fiber Weight	40 oz./sq. yd. (minimum)

- d. The finished carpet shall possess the following physical characteristics:

a.	Finished Pile Height	>2.00" <2.25"
b.	Pile Yarn Weight (Total)	≥ 40 oz./sq. yd.
c.	Primary Backing (Triple Primary)	approx. 8.0 oz/sy

I. Two woven polypropylene, one non-woven

d.	Secondary Urethane Coating	20 oz./sq. yd. (Minimum)
e.	Fabric Width	15'
f.	Tuft Bind Strength	>8 lbs. (without infill)
g.	Tuft Bind Strength	>10 lbs. (with infill)
h.	Grab Tear Strength	>190 lbs.
i.	Pill "Burn" Test	Pass (with filling)
j.	Machine Gauge	≤ ½"
k.	Backing Perforations	3/8" diameter, min 4" x 4" centers.
l.	Impact Attenuation	

I. >90 and <130 G-max value for 30 days following installation

II. No more than 10G increase per year.

III. <175 through life of warranty.

- C. In fill material shall be a controlled mixture of SBR rubber granules and sand. Volumetric ratio shall be a blend per the contractor's system requirements to meet section 2.2C.3.k. (above), (approximately 70% rubber / 30% sand) to be approved by the owner & architect.

1. Rubber:

- a. Cryogenic or ambient ground styrene butadiene rubber (SBR)
 - b. Ethylene propylene dien polymerisat (EPDM)
 - c. Rubber granules must be clean and metal free
2. Sand
- a. Silica sand rounded to sub-rounded
 - b. Silt free
 - c. Granules to be similarly sized
- D. Perimeter edge details, underground storm sewer piping and connections, required for the system shall be as detailed on the drawings with modifications as recommended by the manufacturer, only after approval by the Landscape Architect. The cost for these modifications shall be included in the Contract Sum.
- E. Provide the following maintenance equipment:
1. Grooming Brush – 72” wide for tractor attachment
 2. Field Sweeper – 46” wide for tractor attachment
- F. The entire synthetic infill turf system shall be resistant to attack by bacteria and to fungal growth.
- G. The entire synthetic turf system shall be “lead-free”.

PART 3 - EXECUTION

3.1 GENERAL

- A. The installation shall be performed in full compliance with approved shop drawings.
- B. Only factor-trained technicians skilled in the installation of athletic caliber synthetic turf systems, working under the direct supervision of manufacturer’s supervisors, shall undertake the placement of the system.
- C. The surface to receive the synthetic turf shall be inspected and certified by the installer as ready for the installation of the synthetic turf system and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

3.2 SITE WORK

- A. Fine-grade subgrade to elevations required to create final finish turf elevation flush with concrete perimeter curb. Field to be on uniform plane and grade.
- B. Subgrade: Laser grade the subgrade to a tolerance of ± 0.5 ” of design elevation. Proof-roll the subgrade to assure a consistent and uniform compaction of a least 92% across the entire field. The Owner’ Testing and Inspection Agency will inspect the subgrade and inform the contractor of acceptance of the subgrade conditions. Acceptance of the subgrade is required before the contactor can commence drainage installation and/or gravel base placement. The Owner reserves the right to inspect and test the subgrade as it deems appropriate, including employing a certified

surveyor. Such acceptance, however, does not relieve the Bidder of responsibility for complying with these specifications.

- C. Drainage: Install drainage according to turf manufacturer's recommendations and connect the drainage to storm water structures within the confines of the site.
- D. Gravel Base: Install a minimum of 6" of base gravel across the subgrade. Prior to gravel placement, cover entire subgrade and wrap all drainage trenches with a minimum 3 oz geotextile fabric. Grade finished surface of gravel base to a tolerance of ± 0.5 " across the entire field, with variations of less than 0.25" in any 10 lineal feet. The Owner's Testing and Inspection Agency may inspect the finished gravel grade and will provide the Contractor with a written acceptance of the finished surface conditions. Acceptance of the finished gravel surface is required before the installer can commence shock pad and/or carpet installation. The Owner reserves the right to inspect and test the finished gravel surface, as it deems appropriate, including employing a certified surveyor to assure elevation conformance and/or a geotechnical firm to test gravel permeability. Such acceptance, however, does not relieve the Bidder of responsibility for complying with these Specifications.

3.3 INSTALLATION

- A. The Owner reserves the right to inspect the subbase by means of a laser level. Based on the Contractor's inspection of the topological survey, the Contractor shall fine grade the subbase suitable, including properly rolling and compacting the base.
- B. The contractor shall thoroughly inspect all materials delivered to the site, both for quality and quantity, to assure that the entire installation shall have sufficient material to maintain proper missing ratios.
- C. Synthetic turf shall be loose laid across the field, stretched, and attached to the perimeter edge detail. Turf shall be of sufficient length to permit full cross-field installation, from football sideline to football sideline. Turf shall be laid such that head seams and other seams are minimized. Coordinate with Landscape Architect prior to ordering materials.
- D. Seams shall be adhered using turf manufacturer's recommendations. All seams shall be transverse to the field direction: i.e., run perpendicularly across the field. Seams shall be flat, tight, and permanent with no separation or fraying.
- E. Infill materials must be mixed off site by an experience soils blender and bought to the site and stockpiled for inspection by the owner. The sand/rubber blend shall be applied in numerous thin lifts using special broadcasting equipment. The turf shall be raked and brushed properly as the mixture is applied. The infill material shall be installed to a depth of about 1.75 inches. The mixture can only be applied when dry.

3.4 FIELD MARKINGS AND DECORATIONS

- A. Markings are to be per the plan and must comply with all NIRSA guidelines.
- B. Field Markings see details on plans.
- C. Turf color to be Standard Green.

3.5 CLEAN UP

- A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.
- B. All usable remnants of new material shall become the property of the Owner.
- C. The Contractor shall keep the area clean throughout the project and clear of debris.
- D. Surfaces, recesses, enclosures, etc., shall be cleaned, as necessary, to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.6 MAINTENANCE

- A. At the completion of the project and before the Owner takes possession of the synthetic turf field, the turf contractor shall provide on-site maintenance and care training to Owner. The training shall include but is not limited to the following:
 - 1. Field sweeping and field grooming
 - 2. Description of inlaid field markings
 - 3. Application of temporary markings
 - 4. Cleaning and stain removal
 - 5. Minor seam repair
 - 6. Redistribution of infill material
 - 7. Management of infill compaction
 - 8. General turf care and maintenance
 - 9. Schedule of turf performance testing
- B. Between 12 -18 months following substantial completion, the turf contractor shall be responsible for arranging and paying for an annual maintenance program. The program should include a deep clean, groom and sanitization of the field using a Sport Champ, as manufactured by SMG. The turf contractor shall provide this service for three (3) times: once at 12-18 months following substantial completion and then twice more each of the following calendar years for a total of three (3) visits. The process shall include tining, sweeping, grooming and a sanitization spray.

END OF SECTION 321818

SECTION 321819 – SYNTHETIC TURF ATHLETIC FIELD – BID ALTERNATE ALT. #1

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.
- B. Refer to Section 321818 Synthetic Turf Athletic Field. All requirements in the base bid are to apply to this Alternate #1, with the exception of the sand/rubber infill material.

1.2 SUMMARY

A. Section Includes:

- 1. This specification is for installation of the alternative field turf infill material including shock pad, to be installed in lieu of the sand/rubber infill mix denoted in the base bid.

1.3 SUBMITTALS

- 1. Per Base Bid
- 2. Sand mix with designated properties. One sample.
- 3. Shock attenuation pad –12”x12” sample.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Per Base Bid

2.2 MATERIALS

A. Synthetic Turf:

- 1. Per base bid.

B. In-fill Material

- 1. The infill material shall be a clean, rounded and highly uniform silica sand pigmented and sealed with an acrylic polymer. The sealed silica sand product shall have a Coefficient of Uniformity (Cu) of ≤ 1.3 , with $>93\%$ of the particles retained on US Standard Sieves 12 thru 20, have a Mohs hardness ≥ 6 and a bulk density $\geq 100\text{lbs/ft}^3$. It shall be smooth to resist mounding and compaction and have an angle of repose of 30% or less. The finished product shall be 100% coated, shall repel water and be essentially

dust-free, non-toxic and free of all heavy metals. Envirofill®, manufactured by USGreentech, LLC (Basis of design) or equal approved by the owner & landscape architect.

- C. Elastic Layer Shock / underlayment Pad (if required by manufacturers system)
1. The shock attenuation pad shall be a minimum 10mm pre-formed pad, manufactured in 4' widths (Regupol SP, or equal). All lateral and butt seams of adjoining rolls shall be fastened to assure a monolithic pad upon completion.
 2. Shock pad shall possess these physical characteristics:
 - a. Thickness 10mm
 - b. Weight >10lbs/sq. yd.
 - c. Water Permeability 0.9cm/s
- D. Perimeter edge details, underground storm sewer piping and connections, required for the system shall be as detailed on the drawings with modifications as recommended by the manufacturer, only after approval by the Landscape Architect. The cost for these modifications shall be included in the Contract Sum.

PART 3 - EXECUTION

3.1 GENERAL

- A. Per Base Bid

3.2 SITE WORK

- A. Per Base Bid

3.3 INSTALLATION

- A. Per Base Bid.
- B. Infill materials must be mixed off site by an experienced soils blender and brought to the site and stockpiled for inspection by the owner. The sand blend shall be applied in numerous thin lifts using special broadcasting equipment. The turf shall be raked and brushed properly as the mixture is applied. The infill material shall be installed to a depth of about 1.75 inches. The mixture can only be applied when dry.
- C. Elastic layer shock / underlayment pad shall be installed per manufacturer's recommendations.

END OF SECTION 321819

SECTION 323113 CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. PVC-coated, steel chain-link fabric
 - 2. Polymer-coated steel framework
 - 3. Swing gates
 - 4. Baseball backstop
 - 5. Fencing inside the Support Building.
 - 6. Sports Netting
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete.
 - 2. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where chain-link fences and gates are located.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 8 feet high, and post spacing not to exceed 10 feet for 8 foot height vinyl coated chainlink fence.
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Wind Loads: 90mph. 30mph for ice.
 - b. Exposure Category: B.
 - c. Fence Height: 20 feet .
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.
- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 DEFINITIONS

- A. CLFMI: Chain Link Fence Manufacturers Institute.
- B. Zn-5-Al-MM Alloy: Zinc-5 percent aluminum-mischmetal alloy.

1.5 SUBMITTALS

- A. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements and attachments.
 - 3. Gates and hardware.
- B. Shop Drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of gates, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage and attachment and bracing. Indicate sloping or stepping as required to meet finish grade conditions.
- C. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Samples for Verification: For the following products, in sizes indicated, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the Work.
 - 1. Polymer coating in 6-inch lengths on shapes for posts, rails, and gate framing members.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.
- C. Comply with CLFMI's Product Manual.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: 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 Construction Manager not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Construction Manager's written permission.
- B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Recycled content of products: Provide products with pre-consumer and/or post-consumer recycled content, as available.
- B. Regional Materials: Provide products that are extracted, processed, and manufactured within 500 miles of the project site, as available.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: The design for all vinyl-coated chain-link fencing, gates, and backstop is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 - 1. Basis of Design: Master-Halco; (800) 869-7600.
 - 2. Hoover Fence; (800) 355-2335.
 - 3. Boundary Fence; (800) 628-8928.

2.3 CHAIN-LINK FENCE FABRIC

- A. Steel Chain-Link Fence Fabric: Height indicated on Drawings. Comply with CLFMI's "Product Manual" and with requirements indicated below:
 - 1. Mesh and Wire Size: 2-inch mesh, 9 gauge core wire.
 - 2. Polymer coated fabric: ASTM F 668, Class 2b, over zinc coated steel wire.
 - a. Color: Black.
- B. Selvage: Knuckled at both top and bottom selvages.

2.4 FENCE FRAMING

- A. Round Steel Pipe: Type I, standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083. Minimum yield strength of 25,000 psi. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc.

1. Line, End, Corner, and Pull Posts and Top Rail: Per requirements for Light Industrial Fence.
- B. Top Rails: Fabricate top rail from lengths 20 feet (6.4 m) or longer, with swaged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fabric. Center rail couplings and joints on posts.
- C. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate, end and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.
- D. Intermediate Rails: Match top rail for coating and strength and stiffness requirements.
- E. Bottom Rails: Match top rail for coating and strength and stiffness requirements.

2.5 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 824 and the following:
 1. Coating: Type II, zinc coated (galvanized) with the following minimum wire complying with ASTM A 824 and the following:
 - a. Class 2: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.

2.6 SWING GATES

- A. General: Comply with ASTM F 900 for the following swing-gate types:
 1. Single leaf gate.
 2. Double leaf gate.
- B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- C. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F 900 for the following gate fabric height:
 1. Gate Fabric Height: 6 feet (1.83 m) or less.
- D. Frame Corner Construction:
 1. Welded.
- E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900.
- F. Hardware: Hot dipped galvanized steel or malleable iron shapes to suit gate size.
- G. Hinges: Structurally capable of supporting gate load and allowing opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing outward.

- H. Latches: Capable of retaining gate in closed position and have provisions for padlock. Latch shall permit operation from either side of gate. Provide padlock with two sets of keys for each gate.
- I. Keepers for each leaf of double gate: Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.
- J. Double Gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of patch, requiring one padlock for locking both gate leaves.

2.7 FITTINGS

- A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.
- B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dipped galvanized cast iron. Provide weather tight closure cap for each post.
- C. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dipped galvanized iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Hot-dip galvanized pressed steel or round steel tubing. Not less than 6 inches (153 mm) long.
 - 2. Rail Clamps: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line to line posts.
- E. Tension and Brace Bars: Hot-dip galvanized pressed steel, not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- F. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.
- G. Pipe Sleeves: For posts set into concrete, provide preset hot-dip galvanized steel pipe sleeves complying with ASTM A 53, not less than 6 inches (150mm) long with inside dimensions not less than 1/2 inch (13 mm) more than outside dimension of post, and flat steel plate forming bottom closure.
- H. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 9 gauge, 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
 - 2. Round Wire Hog Rings: Hot-dip galvanized steel for attaching chain-link fabric to horizontal tension wires.

2.8 GROUT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

2.9 POLYMER FINISHES

- A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.
 - 1. Polymer Coating: Class 2a coating, not less than 10-mil (0.245 mm) thick PVC.
 - 2. Color: Black, complying with ASTM F 934.

2.10 NYLON SPORTS NETTING

- A. Basis of design: Ball Fabrics #36 Knotted Nylon Baseball and Softball Netting
 - 1. 1 3/4" Square Mesh. UV Treated Black. Direct impact netting.
 - 2. Breaking Strength: 340 lbs
 - 3. Burst Strength: 441 lbs.
 - 4. Netting to have hemmed perimeter nylon rope.
- B. Steel support wire. 3/8" galvanized steel cable along top of posts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
- C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set terminal, line, & gate posts in concrete footing. Protect portion of posts aboveground

from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is not permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

1. Exposed Concrete Footings: Extend concrete 2 inches (50 mm) above grade, smooth, and shape to shed water.
2. Concealed Concrete Footings: Stop footings below grade as indicated on Drawings to allow covering with surface material.
3. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.
- B. Line Posts: Space line posts uniformly at 10 feet (2.44 m) o.c. maximum.
- C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- D. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (609 mm) o.c. Install tension wire in locations indicated before stretching fabric.
 1. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same gauge and type of wire.
- E. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.
- F. Intermediate Rails: Install in one piece at center span, spanning between posts, using fittings, special offset fittings, and accessories.
- G. Bottom Rails: Install, spanning between posts, using fittings and accessories.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released. Sand down any sharp edges on fabric.

- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts 12 inches (304 mm) o.c. and to braces 24 inches (609 mm) o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GATE INSTALLATION

- A. General: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.7 CLEANING

- A. Touch-up Painting: After installation, touch up areas of fence where painted finish is damaged. Use a compatible, durable exterior paint, recommended or approved by manufacturer. Match color and texture of shop finish.
- B. Clean up debris and unused material and remove from the site.

END OF SECTION 323113

SECTION 323223 - SEGMENTAL RETAINING WALLS

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 single depth segmental retaining walls with soil reinforcement.
- B. Related Sections:
 - 1. Section 033000 "Cast-in-Place Concrete" for segmental retaining wall footings.
 - 2. Section 042000 "Unit Masonry" for decorative concrete masonry units with faces required to match segmental retaining wall units.
 - 3. Section 312000 "Earth Moving" for excavation for segmental retaining walls.

1.3 PERFORMANCE REQUIREMENTS

- A. Basis of Design: Design of segmental retaining walls is based on products indicated. If comparable products of other manufacturers are proposed, provide engineering design for proposed products, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Delegated Design: Design segmental retaining walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Performance: Engineering design shall be based on the following loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."
 - 1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
 - 2. Superimposed loads (surcharge) indicated on Drawings.
- D. Seismic Performance: Engineering design shall be based on the following loads and factors and be according to NCMA's "Segmental Retaining Walls - Seismic Design Manual." As per local requirements.
 - 1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
 - 2. Horizontal Peak Ground Acceleration (A) for Project:

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:
 - 1. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D 6706.
 - 2. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For concrete units.
- C. Samples for Verification: For each color and texture of concrete unit required. Submit full-size units.
 - 1. Include one full-size unit for each type of concrete unit required.
- D. Delegated-Design Submittal: For segmental retaining walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Certificates: For segmental retaining wall units and soil reinforcement, from manufacturer.
 - 1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
 - 2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to segmental retaining walls including, but not limited to, the following:
 - a. Structural load limitations.
 - b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Field quality-control procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.
- B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them.

Verify identification of geosynthetics before using and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 SEGMENTAL RETAINING WALL UNITS

- A. Concrete Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch from specified dimension.
1. Manufacturers: Subject to compliance with requirements licensees of one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Europa Series, Abbey Blend pattern, Stoncreek color or comparable product by a licensee of one of the following:
 - a. Allan Block Corporation.
 - b. Anchor Wall Systems, Inc.
 - c. Keystone Retaining Wall Systems, Inc.; a Contech company.
 3. Provide units that comply with requirements for freeze-thaw durability.
 4. Provide units that interlock with courses above and below by means of integral lugs or lips or hollow cores filled with drainage fill.
- B. Color: As indicated by manufacturer's designations
- C. Shape and Texture: Provide units of basic shape and dimensions indicated with machine-split textured exposed faces.
- D. Shape and Texture: Provide units matching basic shape, dimensions, and face texture indicated by referencing manufacturer's pattern designation.
- E. Shape and Texture: Provide units of any basic shape and dimensions that will produce segmental retaining walls of dimensions and profiles indicated without interfering with other elements of the Work and with machine-split textured, flat exposed face.
- F. Batter: Provide units that offset from course below to provide 1:8 batter.
- G. Cap Units: Provide cap units of same shape as other units with smooth, as-cast top surfaces without holes or lugs.
- H. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face.

2.2 INSTALLATION MATERIALS

- A. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.
- B. Leveling Base: Comply with requirements in Section 334600 "Subdrainage" for drainage fill.
- C. Drainage Fill: Comply with requirements in Section 334600 "Subdrainage."
- D. Reinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

- E. Reinforced-Soil Fill: ASTM D 2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; meeting the following gradation according to ASTM C 136: 20 to 100 percent passing No. 4 sieve, 0 to 60 percent passing No. 40 sieve, 0 to 35 percent passing No. 200 sieve, and with fine fraction having a plasticity index of less than 20.
- F. Subdrainage Pipe and Filter Fabric: Comply with requirements in Section 334600 "Subdrainage."
- G. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:
 - 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]:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Reading Rock Europa Series, Abbey Blend pattern, Stonecreek color, segmental wall blocks. or comparable product by one of the following:
 - a. Strata Systems, Inc.
 - b. Tensar Earth Technologies, Inc.
 - c. Versa-Lok Retaining Wall Systems; a division of Kiltie Corporation.
 - 3. Product Type: Knitted or woven geogrid made from polyester yarns with a protective coating.
- H. Fence post footing: Sleeve-it post foundation system. Install per manufacturer's specifications.

2.3 SOURCE QUALITY CONTROL

- A. Direct manufacturer to test and inspect each roll of soil reinforcement at the factory for minimum average roll values for geosynthetic index property tests, including the following:
 - 1. Weight.
 - 2. Roll size.
 - 3. Grab or single-rib strength.
 - 4. Aperture opening.
 - 5. Rib or yarn size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RETAINING WALL INSTALLATION

- A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.
 - 1. Lay units in Abbey Blend bond pattern.

2. Form corners and ends by using special units.
- B. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.
 1. Leveling Course: Crushed washed #57 aggregate. Compact and screed to a smooth, level surface.
 - C. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.
 1. Tamp units into leveling base as necessary to bring tops of units into a level plane.
 - D. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
 1. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
 - E. Cap Units: Place cap units and secure with cap adhesive.
- 3.3 FILL PLACEMENT
- A. General: Comply with requirements in Section 312000 "Earth Moving" NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.
 - B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.
 - C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.
 1. Use only hand-operated compaction equipment within 48 inches of wall, or one-half of height above bottom of wall, whichever is greater.
 2. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D 698.
 - a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D 698.
 3. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."
 - D. Place a layer of drainage fill at least 12 inches wide behind wall to within 12 inches of finished grade. Place a layer of drainage geotextile between drainage fill and soil fill.
 - E. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated, sloped not less than 0.5 percent to drain.
 - F. Place impervious fill over top edge of drainage fill layer.
 - G. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at base of wall away from wall. Provide uniform slopes that will prevent ponding.
 - H. Place soil reinforcement in horizontal joints of retaining wall where indicated and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.

1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
2. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
3. Do not dump fill material directly from trucks onto geosynthetics.
4. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1/2 inches in 10 feet, maximum.
- B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 3/4 inches in 10 feet.
- C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1/2 inches in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Comply with requirements in Section 312000 "Earth Moving" for field quality control.
 1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 36 inches of fill depth and each 75 feet or less of segmental retaining wall length.

3.6 ADJUSTING

- A. Remove and replace segmental retaining wall construction of the following descriptions:
 1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.
 2. Segmental retaining walls that do not match approved Samples.
 3. Segmental retaining walls that do not comply with other requirements indicated.
- B. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 323223

SECTION 329200 TURF AND GRASSES

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. Soil preparation
2. Seeding lawns
3. Seed mixes
4. Erosion-control material(s).
5. Maintenance

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Division 32 Section "Plants" for border edgings.
4. Division 33 Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of Grass Seed: Seed vendor's certification for grass seed, indicating the botanical and common name, percentage by weight of each species and variety, percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Sod vendor's certification of each seed mixture for turfgrass sod, indicating percentage of grass species, and purity. Include identification of source, and name and phone number of supplier.
 - 2. Submit schedule of sodding and seeding operations including seeding methods for lawns that will be employed
- C. Qualification Data: For qualified landscape installer
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For imported or manufactured topsoil.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications, if other than the landscape contractor: An experienced Installer with a minimum of 5 years experience, who has completed landscaping work similar in material, design, and extent to that indicated for this Project, and with a record of successful landscape establishment.
 - 1. Prior to award of the contract, the installer shall submit a list of three (3) completed commercial projects comparable in size indicating project name, address, telephone number and name of contact persons.
 - 2. Installer's Field Supervision: Installer shall maintain an experienced full-time supervisor on the Project site during times that sodding and seeding is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of test to be performed.
- C. Soil Analysis:
 - 1. For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating the following data:

- a. percentage of organic matter
 - b. gradation of sand, silt, and clay content
 - c. cation exchange capacity; deleterious material
 - d. ph factor
 - e. mineral and plant-nutrient content of the soil.
2. Report suitability of tested soil for turf growth.
 - a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. for nitrogen, phosphorus, and potash nutrients, and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
- D. Coordinate with work of other trades and activities, particularly with sequencing of finish grading, irrigation and planting.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- C. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

- A. Work notification: Notify Owner's Representative at least 7 working days prior to start of sodding and seeding operations.
- B. Protect existing utilities, paving, and other facilities from damage caused by sodding and seeding operations.
- C. Perform work only after finish grading and planting and any other work affecting ground surface is completed and has received approval from the Owner's Representative.
- D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.
- E. Provide hoses and lawn-watering equipment as required.
- F. G.Seeding Periods: Seeding of permanent lawn to occur from March 15 through May 15, or from September 1 through October 15. Seeding operations at other times shall be only with the approval of the Owner's Representative and at the Contractor's risk.

- H. 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.

1.8 WARRANTY

- A. Provide a uniform stand of grass by maintaining lawn areas until Final Acceptance. Re-sod or re-seed areas, with specified materials, which fail to provide a uniform stand until all affected areas are accepted by the Owner's Representative.

PART 2- PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Grass Seed Mix: Turf-type tall fescue blend (*Festuca arundinacea* "Finelawn Petite" or equal. Commonly available varieties considered of equal quality include, but are not limited to: Adobe, Apache, Amigo, Aztec, Bonanza, Cochise, Crossfire, Falcon, Guardian, Houndog, Jaguar 3, Mustang, Olympic, Shortstop). KY 31 Tall Fescue will not be acceptable.
- B. Turfgrass Species: Turf-type tall fescue blend (*Festuca arundinacea*).

2.2 INORGANIC SOIL AMENDMENTS

- A. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve, prilled (coated, controlled release).
- B. Aluminum Sulfate: Commercial grade, unadulterated, granulated agricultural.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, humus rich type derived from the decomposition of leaves and yard wastes. Animal or poultry manure, at any stage of decomposition, shall not be acceptable. Texture shall be similar to a shredded peat; pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; soluble salt content of 10 decisiemens/m, maximum; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 30 percent, minimum, of dry weight.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.6 PLANTING SOILS

- A. Planting Topsoil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable topsoil. ASTM D 5268 topsoil, with pH range of 6.0 to 7.5, a minimum of 6 percent organic material content as determined by loss on ignition of samples oven-dried to constant weight at 212 degrees F; free of stones 1 inch or larger in any dimension. Remove 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.

2.7 MULCHES

- A. Straw mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch, nontoxic and free of plant-growth or germination inhibitors, with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer to slurry application; nontoxic and free of plant-growth or germination inhibitors.

- D. Asphaltic Emulsion: ASTM D 977, Grade SS-1 nontoxic and free of plant-growth or germination inhibitors.

2.8 PESTICIDES

- A. General: Pesticide, registered and approved by 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 Non-Selective): 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 Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 WATER

- A. Water: Potable, clean fresh and free from harmful materials.

2.10 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Examine finish graded surfaces, grades, topsoil quality and depth. Existing topsoil for lawns shall meet elevations indicated on the Drawings. Notify Owner's Representative of any deficiencies.
 - 2. Lawn areas shall be free of brush piles and construction debris.
 - 3. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

4. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
5. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
6. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

3.3 SOIL EROSION CONTROL

A. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Erosion control measures include placement of erosion barriers such as silt fence or staked hay bales, and temporary seeding.

B. Provide temporary seeding to stabilize soils when permanent seeding is prohibitive due to inappropriate planting season or limitations from project sequencing.

3.4 TURF AREA PREPARATION

A. Limit preparation to areas that will be immediately seeded.

B. Finish Grading:

1. Remove existing grass, vegetation and turf.
2. Remove sticks, roots, and stones over 1" in any dimension and other extraneous matter.
3. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers as recommended by the soil text, and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture. Finish graded areas without existing cover shall be tilled if compacted.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½ inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Spread planting soil in areas where topsoil depth is deficient. Do not spread if planting soil or existing topsoil is frozen, muddy or

excessively wet. Surface shall be graded to such elevation so the lawn, when in place, shall be flush with any adjacent turf area, pavement or curb.

- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Owner's Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.6 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when the soil is saturated or when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- B. Do not use wet seed or seed that is moldy or otherwise damaged.
- C. Sow seed at a total rate of 7-8 lbs. per 1000 sq. ft.
- D. Rake seed lightly into top 1/8 inch of soil, roll with light lawn roller Cultipacker (Brillion), and water with fine spray.
- E. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas.
- G. Spread by hand, blower, or other suitable equipment.
 - 1. Bond straw mulch by spraying with asphalt emulsion at a rate recommended by the manufacturer. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.7 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 2. Apply slurry uniformly to all areas to be seeded. Apply at a rate so that the mulch component is deposited not less than the manufacture's recommendations, and the seed component is deposited at not less that the specified seed-sowing rate.

3.9 TURF MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following period:
1. Seeded Lawns: 60 days after date of Substantial Completion, except when full maintenance period has not elapsed before end of fall planting season, or if lawn has not fully established at that time, then maintenance period shall continue into spring planting season.
- B. 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 remulch 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. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. 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.
- C. 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.
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 per week unless rainfall precipitation is adequate.
- D. Mowing: Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matter. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the specified lawn height.
- E. Turf Post-fertilization: Apply fertilization to lawn after first mowing and when grass is dry. Apply fertilizer at rates that will provide actual nitrogen of at least 1 lb. Per 1000 sq. ft. of lawn area or at rate determined by topsoil test recommendations.

3.10 SATISFACTORY TURF

- A. Inspection to determine final acceptance of lawn areas will be made by the Owner's Representative, upon Contractor's request. Provide notification at least 10 working days before requested inspection date.
 - 1. Satisfactory Seeded Turf: Will be acceptable provided all requirements, including maintenance, have been complied with and 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. and bare spots not exceeding 5 by 5 inches.
 - 2. Satisfactory Sodded Turf: Will be acceptable provided all requirements, including maintenance, have been complied with and a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified material to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- C. Upon acceptance, the owner will assume lawn maintenance.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with 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 Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 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. 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.
- C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 334100 - STORM UTILITY DRAINAGE 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. Section Includes:
 - 1. Pipe and fittings.
 - 2. Drains.
 - 3. Catch basins.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and 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.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. 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.
- D. Handle catch basins according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage 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 _____
_____δ_____KM_____

2.3 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, 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 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. 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 A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.4 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
 4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
 8. 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 catch basin to finished grade is less than 60 inches (1500 mm).
 9. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

- B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
 - 1. Joint Sealants: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 - 2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 - 3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
 - 4. 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 catch basin to finished grade is less than 60 inches (1500 mm).
 - 5. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
 - 1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
 - 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
- D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.
 - 1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage 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 use of 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.
 - 2. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 3. Install PE corrugated sewer piping according to ASTM D 2321.
 - 4. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
 - 5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
 - 8. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - 9. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

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 gasketed 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 culvert piping according to AWWA C600 for push-on joints.
 - 5. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - 6. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
 - 7. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
 - 8. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 - 9. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - 10. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
 - 11. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
 - 12. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - 13. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - 14. Join fiberglass sewer piping according to ASTM D 3839 for elastomeric-seal joints.

15. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
 2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
 3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
 4. Use Extra-Heavy-Duty, top-loading classification drains in roads.
- B. Embed drains in 4-inch (102-mm) minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections in 4-inch (102-mm) minimum concrete around bottom and sides.

3.5 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.6 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.7 CONNECTIONS

- A. 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. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED STORM DRAINAGE 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. Backfill to grade according to Section 312000 "Earth Moving."

3.9 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 1. Submit separate reports 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. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).
- 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.

3.11 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334100