

PROJECT MANUAL TECHNICAL SPECIFICATIONS 2nd City Submittal



City of Buckeye
Fire Station No. 705
Buckeye, AZ



EXPIRES: 12-31-2021

 **Perlman**
Architects of Arizona

ARCHITECT'S PROJECT NO. 318009
July 17, 2019

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REPORT ON GEOTECHNICAL INVESTIGATION
(30 pages total including this cover sheet)

**REPORT ON GEOTECHNICAL
INVESTIGATION**



DESIGNATION: Buckeye Fire Station #705

LOCATION: SEC Tartesso Parkway & Allyson Avenue
Buckeye, Arizona

CLIENT: Perlman Architects of Arizona, Inc.

PROJECT NO: 190095SA

DATE: February 13, 2019

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1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed Town of Buckeye Fire Station #705. The site is located on the southeast corner of Tartesso Parkway & Allyson Avenue in Buckeye, Arizona. Grading and drainage plans were not available at the time of writing this report. It is assumed that grades will remain essentially unchanged or within 1 foot of existing. If this is not the case, we should be notified so that we may revise our report accordingly.

We understand that construction will consist of a 3 apparatus high bay fire station with living quarters and support spaces. The building will be single story with slab on grade and masonry wall construction. Structural loads will be light to moderate and no special considerations regarding settlement tolerances are known at this time. Adjacent areas will be landscaped or paved to support moderate passenger and light truck traffic. Landscaped areas will be utilized for storm water retention and disposal.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is bounded on the north by Tartesso Parkway, on the east and south by playing fields and the community park, and on the west by vacant residential lots followed by Allyson Avenue. The site is currently a vacant lot with some scattered weeds. Based on review of historical aerial photos the site was native desert till around 2006 when mass grading started on the area. A prior wash was located on the south edge of the property. Please refer to the figures below for details.

Figure 2.1.1 Dated 2004



Figure 2.1.2 Dated 2006



Figure 2.1.3 Dated 2017



2.2 Geologic Conditions

The site is **located outside known areas** that have undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas within several miles of the site. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which would not affect the type of buildings proposed for this site. No evidence of earth fissures was observed on the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located in the Wintersburg Study area near 355th Avenue and Baseline Road several miles to the southwest. Based on local experience, subsidence and earth fissures historically have **not** been a problem in this area.

2.3 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low historical seismicity. The seismicity of the Phoenix area has had only three magnitude 3.0 events in over 100 years. Liquefaction is not considered a concern as groundwater exceeds 15 meters below ground surface.

Although borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the borings and geology in the area, Site Class Definition, Class C may be used for design of the structures. In addition, the following seismic parameters may be used for design (based on IBC 2012/15 and ATC Hazard by Location online Tool):

Table 2.3.1 Seismic Parameters

MCE ¹ spectral response acceleration for 0.2 second period, S _S :	0.155g
MCE ¹ spectral response acceleration for 1.0 second period, S ₁ :	0.053g
Site coefficient, F _a :	1.2
Site coefficient, F _v :	1.7
MCE ¹ spectral response acceleration adjusted for site class, S _{MS} :	0.186g
MCE ¹ spectral response acceleration adjusted for site class, S _{M1} :	0.090g
5% Damped spectral response acceleration, S _{DS} :	0.124g
5% Damped spectral response acceleration, S _{D1} :	0.060g

NOTE 1: MCE = maximum considered earthquake

2.4 General Subsurface Conditions

Subsoil conditions at the site comprise predominantly of clayey sand, sandy clay, and silty sand to the termination depths of the borings at 5.0 to 21.4 feet below existing grade. Subordinate amounts of gravel and cobbles were also noted in the profile. The standard penetration resistance test (SPT) values range from 21 to 50+ blows per foot. Boring B-3 encountered refusal on cobble at approximately 7 feet below grade. No groundwater was encountered during this investigation. Based on visual and tactile observation, the soils were in a 'dry to moist' state at the time of investigation.

Laboratory testing indicates in-situ dry densities of the upper soils in the range of 86.1 to 102.8 pcf and water contents in the range of 5.7 to 8.0 percent at the time of investigation. Liquid limits range from 29 to 35 percent. Plasticity indices are on the order of 12 to 14 percent. The upper clayey soils exhibit volume increase (swell) due to wetting of approximately 2.4 percent when compacted to moisture and density levels normally expected during construction. Undisturbed samples displayed moderate compression (3 to 4%) under incremental loading to a maximum confining load of 3,200 psf and moderate to significant additional compression (**2.5% to 10%**) due to inundation (**hydro-collapse**).

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of the proposed structures on shallow foundations and slab-on-grade subject to remedial earthworks. It is assumed that the overall site grade will remain essentially the same (± 1 foot).

Laboratory and field testing indicates that the upper soils are susceptible to additional compression due to inundation. These conditions could cause excessive settlement resulting in cracking problems. Accordingly, recommendations are made to over-excavate and re-compact the bearing soils to increase density and reduce the potential for collapse. This will also ensure a uniform bearing condition for the new foundations. Attention must be paid to provide and maintain proper drainage to limit the potential for water infiltration of deeper soils.

The swell potential of the fine portion of the upper clayey soils is a concern. The potential is usually strong enough to cause differential movements of slabs-on-grade such as floors and sidewalks and lightly loaded foundation but not enough to cause damage to heavier structures. Accordingly, it is paramount to provide proper drainage to limit the potential for water infiltrating under slabs. Typical recommendations to reduce the swell potential include providing at least **12-inches of non-expansive material** to be placed directly beneath the building slabs and slabs contiguous to the structure such as sidewalks.

For standard foundations to perform as expected, attention must be paid to provide proper drainage to limit the potential for water infiltration of deeper soils. It is assumed that the landscape plan will use mostly low water use or "green" desert type plants (xeriscape). It is preferred to keep irrigated plants at least 5 feet away from structures with irrigation schedules set and maintained to run intermittently. **Unpaved planter areas should be sloped at least 5 percent for a distance of at least 10 feet away from the building.** It is understood that this may not be possible due to ADA maximum slope requirements for the adjacent sidewalks and patios. The slope may be reduced to 2 percent provided extra care is taken to ensure sidewalks and other hardscape features do not create a "dam" that prevents positive drainage away from the buildings, creating a "pond" adjacent to the building. Roof drainage should also be directed away from the building in paved scuppers. Pre-cast loose splash blocks should not be used as they can be dislodged and/or eroded. Roof drains should not be allowed to discharge into planters adjacent to the structure. It is preferred that they be directed to discharge to pavement (per photo example), retention basins or discharge points located at least 10 feet away from the building.



It is reiterated that shallow spread footings are recommended for the exterior walls and other light interior columns since this is the most economical system available. However, this shallow system relies on the dry strength of the unsaturated native soils. **A limited depth of re-compaction is recommended** to increase density of the near surface soils that are more likely to encounter seasonal moisture changes, or deeper foundations. **The deeper native soils are moisture sensitive and could experience differential settlement if subjected to significant surface water infiltration.** Recognizing the need to minimize significant water penetration adjacent to the building perimeter that could detrimentally impact the building foundation, the following additional recommendations are made to protect foundations:

1. Take extra precaution to backfill and compact native soil fill to 95 percent in all exterior wall locations.
2. Avoid utility trenches passing through retention basins leading to the building. If unavoidable, backfill the trench with MAG Section 728 ½-sack CLSM to cut off preferred drainage paths.
3. Create and maintain positive drainage away from the exterior wall for a minimum of 10 feet.
4. Avoid sidewalks, curbs or other elements that create a dam that could cause water to pond within 5 feet of the perimeter wall.
5. Include no irrigated landscape materials in the first 3 feet next to the building.
6. Between 3 feet and 5 feet, include only landscape materials that can be irrigated with a maximum of 1 gallon per hour emitter heads. Set and maintain irrigation controllers to prevent 24/7 flows.
7. Any landscape materials requiring greater than 1 gallon per hour irrigation, including turf, shall be at least 5 feet from the outside face of the building.
8. All irrigation feeder lines, other than those that supply individual emitters, shall not be placed closer than 5 feet to the building.

Groundwater is not expected to be a factor in the design or construction of shallow foundations and underground utilities. Excavation operations should be relatively straightforward with conventional equipment.

For exterior slabs-on-grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of out-swinging doors. Pinning typically consists of 24-inch long No. 4 reinforcing steel dowels placed at 12-inch centers.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Final grades should allow for the placement of 8 inches of non-expansive fill on the building pads.

Subsoils should be further over-excavated **at least 2 feet** below proposed footing bottom elevation, or existing grade, **whichever is deeper**, extending at least 5 feet beyond the footing edges and door landings within all footing areas. The entire building pad does not require over-excavation provided footing lines can be accurately located during grading operations. It may be more feasible to over-excavate the entire building pad if the building footprint is relatively small. A representative of the geotechnical engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials and contact with required soil strata. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

Prior to placing structural fill below footing bottom elevation, the exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum (± 2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be scarified, moisture- conditioned and compacted in a similar manner.

All cut areas and areas above footing bottom elevation that are to receive floor slab only fill should be scarified 8 inches, moisture conditioned to at least optimum ± 2 percent of optimum and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

3.3 Foundation Design

The following bearing capacities can be utilized for design:

Table 3.3.1 Foundation Bearing Capacities

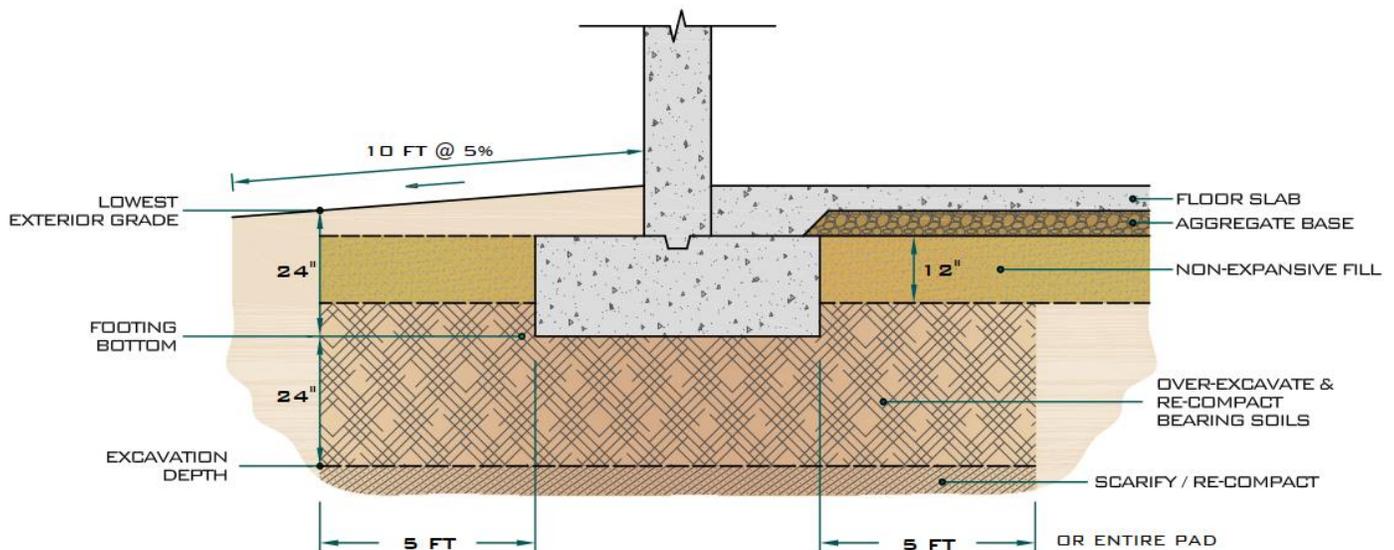
Structure	Foundation Type	Foundation Depth ⁽¹⁾	Bearing Medium	Bearing Capacity	Comments
Minor Structures	Spread	1.5 ft.	Native Soils	1,500 psf	2
Main Structure	Spread	2.0 ft.	2 ft. Engineered Fill	2,500 psf	3

Comments:

1. Foundation Depth refers to minimum depth below **existing grade** or slab level, or finished exterior grade, whichever is greater.
2. For minor structures such as screen walls, planter walls, etc. not connected to any main structure. Compaction of the subgrade to 95 percent standard proctor to at least 8 inches depth is required.
3. Footings to bear on minimum of 2' of engineered fill + 8" pre-compacted subgrade. Refer to Figure 3.3.1.

These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations shall be level and cleaned of all loose or disturbed materials. **Positive drainage away from the proposed building must be maintained at all times.**

Figure 3.3.1 Foundation Detail – Bearing on Engineered Fill



Continuous masonry wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 plf) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width).

Estimated settlements under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content. **Positive drainage away from structures, and controlled routing of roof runoff should be provided to prevent ponding adjacent to perimeter walls.** Planters requiring heavy watering should be considered in this regard. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. Reinforcement and control joints are suggested to allow slight movement and prevent minor floor slab cracking.

3.4 Lateral Pressures

The following lateral pressure values may be utilized for the proposed construction:

Active Pressures

Unrestrained Walls 35 pcf

At-Rest Pressures

Restrained Walls 60 pcf

Passive Pressures

Continuous Footings 300 pcf

Spread Footings 350 pcf

Coefficient of Friction (w/ passive pressure) 0.35

Coefficient of Friction (w/out passive pressure) 0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

3.5 Fill and Backfill

Native clayey soils are considered suitable for use in general grading fills but should **not** be used in the top 12-inches of any slab on grade fill or as retaining/basement wall backfill. The top 12-inches of at-grade building pad fill should be completed with an approved low or non-expansive soil, either approved imported common borrow or select granular soil. If select granular soils are used, the 4 inches of under-slab aggregate base may be included as part of the top 12-inches. Otherwise, 12-inches of approved common borrow should be used in addition to the normal 4 inches of aggregate base.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ± 2 percent (optimum to 3 percent above optimum for under slab and sidewalk fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas	
1.	Below footing level	95
2.	Below slabs-on-grade (non-expansive soils)	95
3.	Below slabs-on-grade (expansive soils)	90-95 (max)
	(Not recommended for the top 12-inches of Pad)	
B.	Pavement Subgrade or Fill	95
C.	Utility Trench Backfill	95
D.	Aggregate Base Course	
1.	Below floor slabs	95
2.	Below asphalt paving	100
E.	Landscape Areas	90

3.6 Utilities Installation

Trench excavations for utilities can be accomplished by conventional trenching equipment. Deeper excavation into the very dense soils may require heavy equipment. The fact that a boring was drilled to a certain depth does not mean that the soils may be excavated by normal means. The excavating contractor must make his/her own assessment as to excavatability. Trench walls should stand near-vertical for the short periods of time required to install shallow utilities although some sloughing may occur in looser and/or sandier soils requiring laying back of side slopes and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches above bedding zones may be carried out with native excavated material provided over-sized material (>3 inches) is first removed. This material should be moisture-conditioned, placed in 8 inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

3.7 Slabs-on-Grade

To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for aggregate base (A.B.) as per M.A.G. Specification Section 702 should be utilized beneath the slab. Dried subgrade soils **must** be re-moistened prior to placing the aggregate base if allowed to dry out, especially if fine-grained soils are used in the top 12-inches of the pad.

The native soils are capable of storing a significant amount of moisture, which could increase the natural vapor drive through the slab. Accordingly, if moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier directly below the concrete is recommended. Vapor barriers should be a minimum 15-mil thick polyolefin (or equivalent), which meets ASTM E 1745 Class A specifications. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low slump concrete, frequent jointing and proper curing will be required to reduce curling potential and detailed to prevent the entrapment of outside water sources.

3.8 Asphalt/Concrete Pavement Design

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The location designation is for reference only. The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy. The section capacity is reported as daily ESALs, Equivalent 18 kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1200 passenger cars to impart 1 ESAL.

Table 3.8.1 Pavement Sections

Area of Placement	Flexible (AC Pavement)			Rigid (PCC Pavement)	
	Thickness		Daily 18-kip ESALs	Thickness PCCP	Daily 18-kip ESALs
	AC (0.39)	ABC (0.12)			
Auto Parking	2.0"	4.0"	4	5.0"	8
Truck Parking, Main Drives	3.0"	4.0"	20	6.0"	21
	3.0"	6.0"	45	7.0"	46
	4.0"	4.0"	100	8.0"	98

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-Values.
2. The PCCP thickness is increased to provide better load transfer, and reduce potential for joint & edge failures. Design PCCP per ACI 330R-87.
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.

Pavement Design Parameters:

Assume:	One 18 kip Equivalent Single Axle Load(ESAL)/Truck
Life:	20 years
Subgrade Soil Profile:	
% Passing #200 sieve:	34%
Plasticity Index:	13%
k:	150 pci (assumed)
R value:	38 (per ADOT tables)
M _R :	23,300 (per AASHTO design)

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the “Site Preparation” and “Fill and Backfill” sections of this report, and paving operations carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710. It is recommended that a ½-inch or ¾-inch mix designation be used for the pavements. The actual mix design may be dependent on the selected pavement section and the specified minimum lift thicknesses for the different types of mixes. **Follow M.A.G. Section 710 for recommended minimum lift thicknesses.** Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier

should be informed of the pavement use and be required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be sufficient. For trash and dumpster enclosures a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength 550 psi (compressive strength of approximately 3,700 psi). It may be cast directly on the prepared subgrade with proper compaction (reduced) and the elevated moisture content as recommended in the report. Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. No reinforcing is necessary. Joint design and spacing should be in accordance with ACI recommendations. Construction joints should contain dowels or be tongue and grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support. If joint sealer is not used, add 4 inches of aggregate base under the concrete to reduce potential for loss of support where water enters joints.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

4.0 GENERAL

The scope of this investigation and report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Soils Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.



Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 2/13/19
ARIZONA, U.S.A.

Keith R. Gravel, P.E.



Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 2/13/19
ARIZONA, U.S.A.

Gregg A. Creaser, P.E.

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CONSOLIDATION TEST

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

FIELD AND LABORATORY INVESTIGATION

On January 21, 2019, soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our soils technician, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-75 drill rig utilizing 7-inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. All field and laboratory data is presented in this appendix.



• - APPROXIMATE SOIL BORING LOCATIONS

BUCKEYE FIRE STATION NO 705
 SEC TARTESSO PARKWAY & ALLYSON AVENUE
 BUCKEYE, ARIZONA

SOIL BORING LOCATION PLAN

SHEET: 1 of 1 DR: MM REV: DATE: 02/04/19 PROJECT NO. 1900955A

SOIL LEGEND

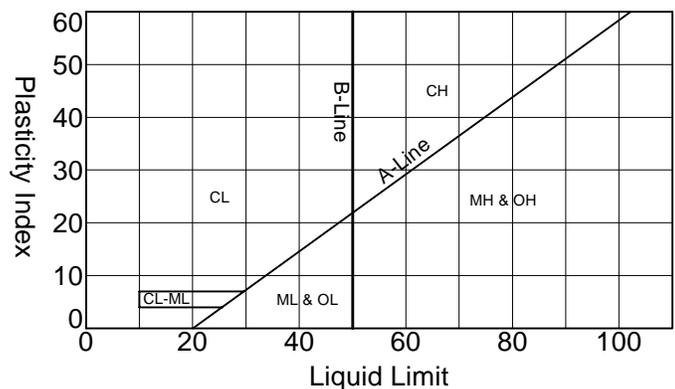
SAMPLE DESIGNATION	DESCRIPTION		
AS	Auger Sample	A grab sample taken directly from auger flights.	
BS	Large Bulk Sample	A grab sample taken from auger spoils or from bucket of backhoe.	
S	Spoon Sample	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.	
RS	Ring Sample	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.	
LS	Liner Sample	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.	
ST	Shelby Tube	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).	
--	Continuous Penetration Resistance	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.	

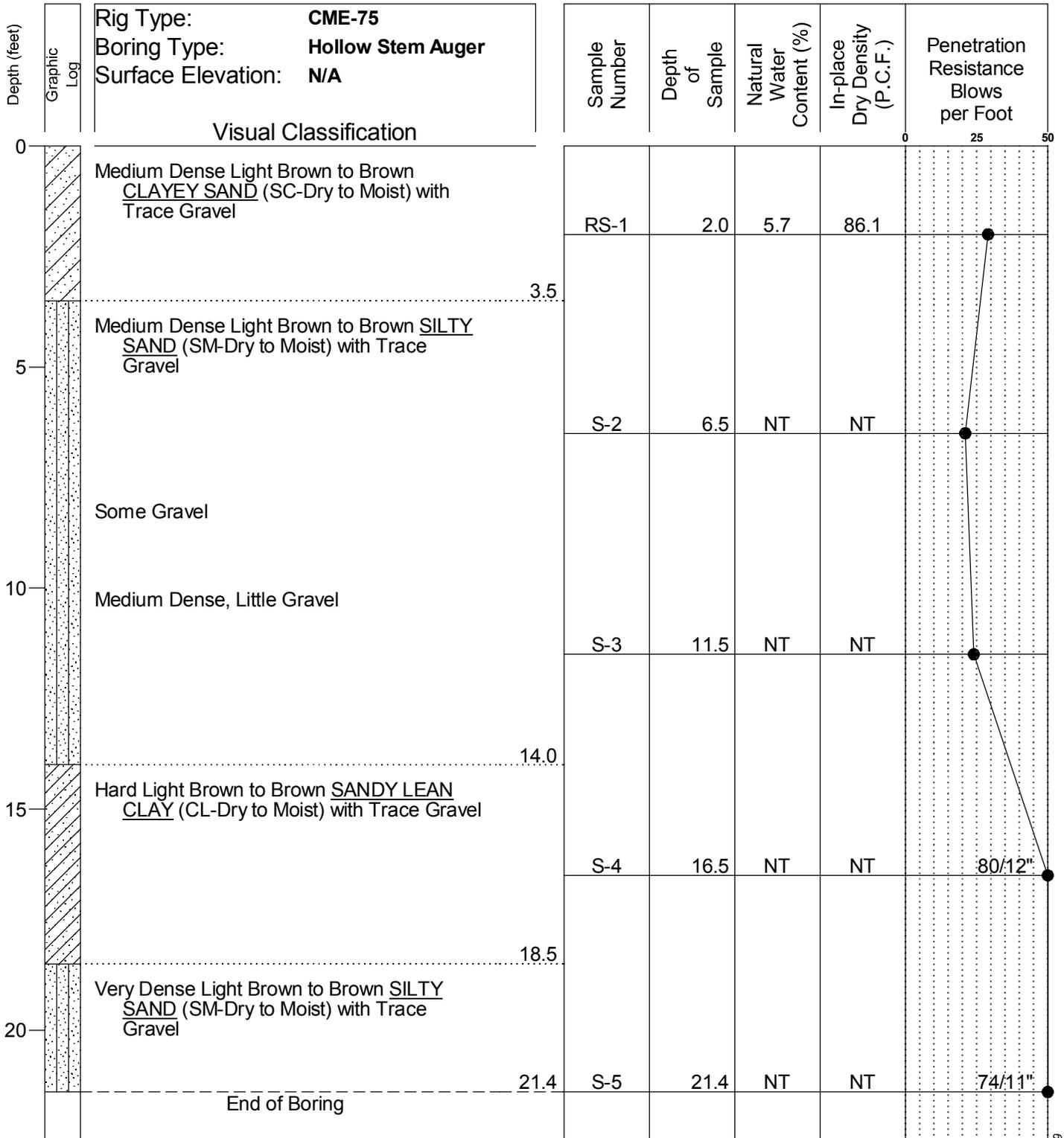
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS <small>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE</small>	CLEAN GRAVELS <small>(LITTLE OR NO FINES)</small>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	SAND AND SANDY SOILS <small>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</small>	CLEAN SANDS <small>(LITTLE OR NO FINES)</small>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		SM	SILTY SANDS, SAND - SILT MIXTURES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS <small>LIQUID LIMIT LESS THAN 50</small>		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS <small>LIQUID LIMIT GREATER THAN 50</small>		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY	
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE				
	Lower Limit		Upper Limit		
	mm	Sieve Size ♦	mm	Sieve Size ♦	
SANDS	Fine	0.075	#200	0.42	#40
	Medium	0.420	#40	2.00	#10
	Coarse	2.000	#10	4.75	#4
GRAVELS	Fine	4.75	#4	19	0.75" x
	Coarse	19	0.75" x	75	3" x
COBBLES	75	3" x	300	12" x	
BOULDERS	300	12" x	900	36" x	
♦U.S. Standard		xClear Square Openings			





Boring Date: 1-21-19
 Field Engineer/Technician: R. Bainum
 Driller: J. Aguilar
 Contractor: Geomechanics SW

Water Level		
Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-1**

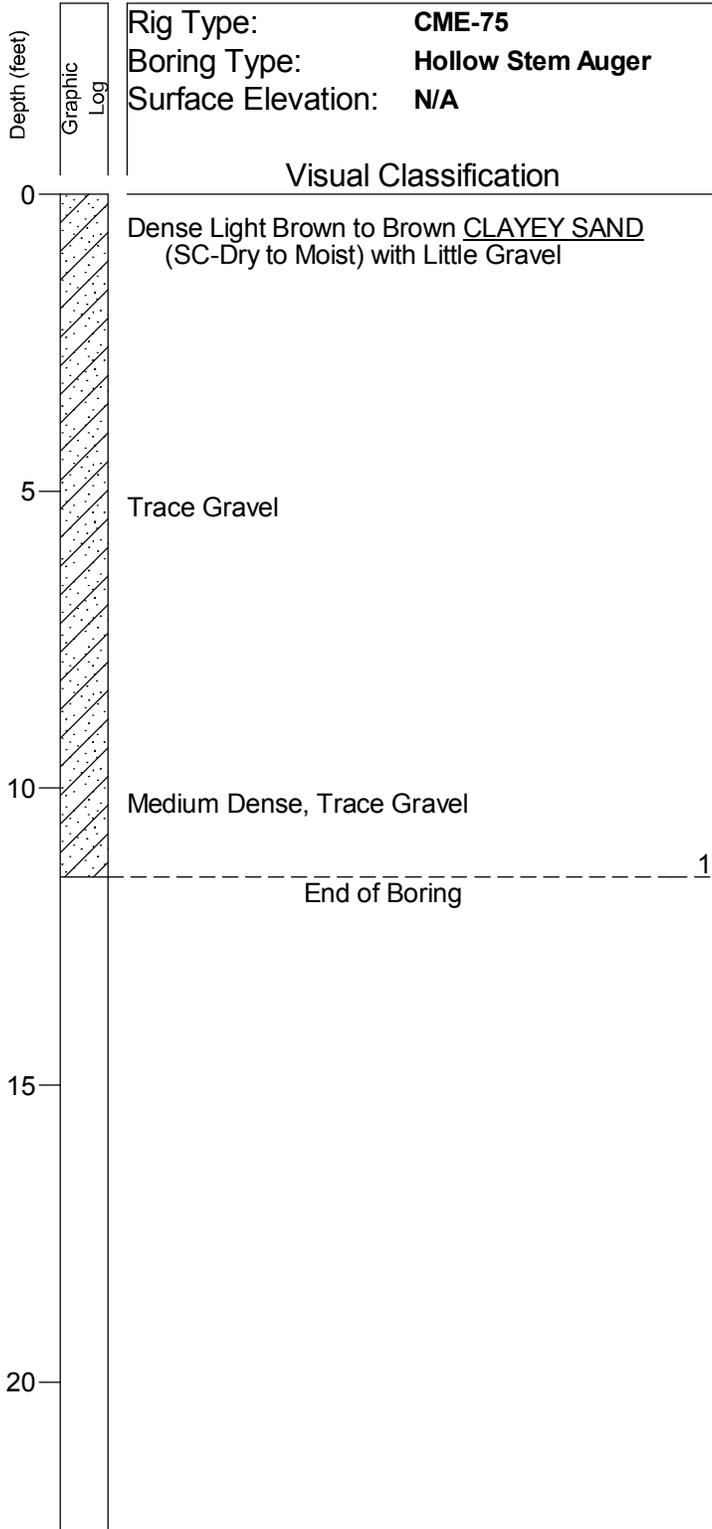
Buckeye Fire Station No 705

SEC Tartesso Parkway & Allyson Avenue

Buckeye, Arizona

Project No.: **1900095SA**

SPEEDIE 190005SA.GPJ GENGE.GDT 2/1/19



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
RS-1	2.0	8.0	102.8	
S-2	6.5	NT	NT	
S-3	11.5	NT	NT	

Boring Date: **1-21-19**
 Field Engineer/Technician: **R. Bainum**
 Driller: **J. Agular**
 Contractor: **Geomechanics SW**

Water Level		
Depth	Hour	Date
<i>Free Water was Not Encountered</i>		

NT = Not Tested

SPEEDIE AND ASSOCIATES

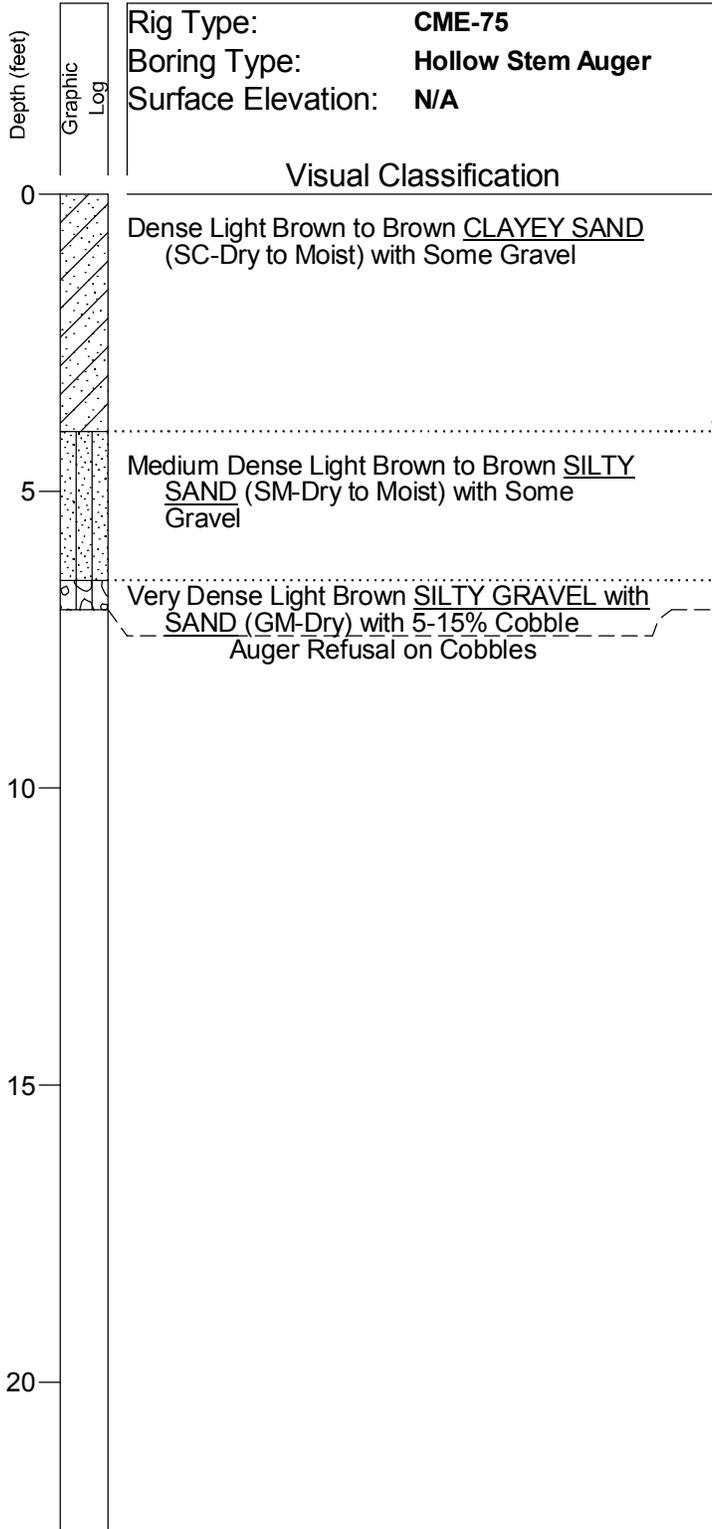
Log of Test Boring Number: **B-2**

Buckeye Fire Station No 705

SEC Tartesso Parkway & Allyson Avenue

Buckeye, Arizona

Project No.: **1900095SA**



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
RS-1	2.0	6.9	91.4	
BS-4	5.0	NT	NT	
S-2	6.5	NT	NT	

Boring Date: **1-21-19**
 Field Engineer/Technician: **R. Bainum**
 Driller: **J. Agular**
 Contractor: **Geomechanics SW**

Water Level		
Depth	Hour	Date
<i>Free Water was Not Encountered</i>		

NT = Not Tested

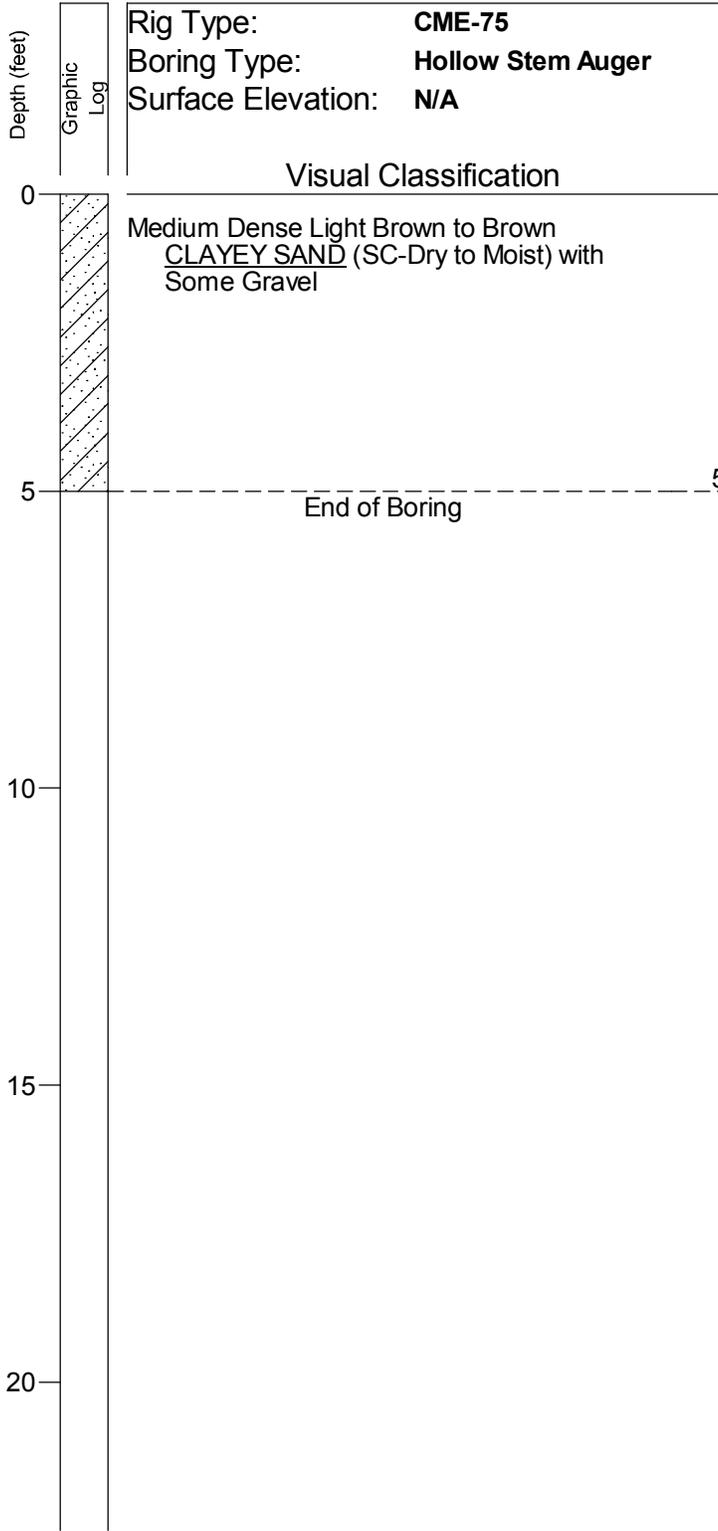
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-3**

Buckeye Fire Station No 705
SEC Tartesso Parkway & Allyson Avenue
Buckeye, Arizona

Project No.: **1900095SA**

SPEEDIE 190005SA.GPJ GENGEO.GDT 2/1/19



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
BS-1	3.0	NT	NT	

Boring Date: **1-21-19**
 Field Engineer/Technician: **R. Bainum**
 Driller: **J. Agular**
 Contractor: **Geomechanics SW**

Water Level		
Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

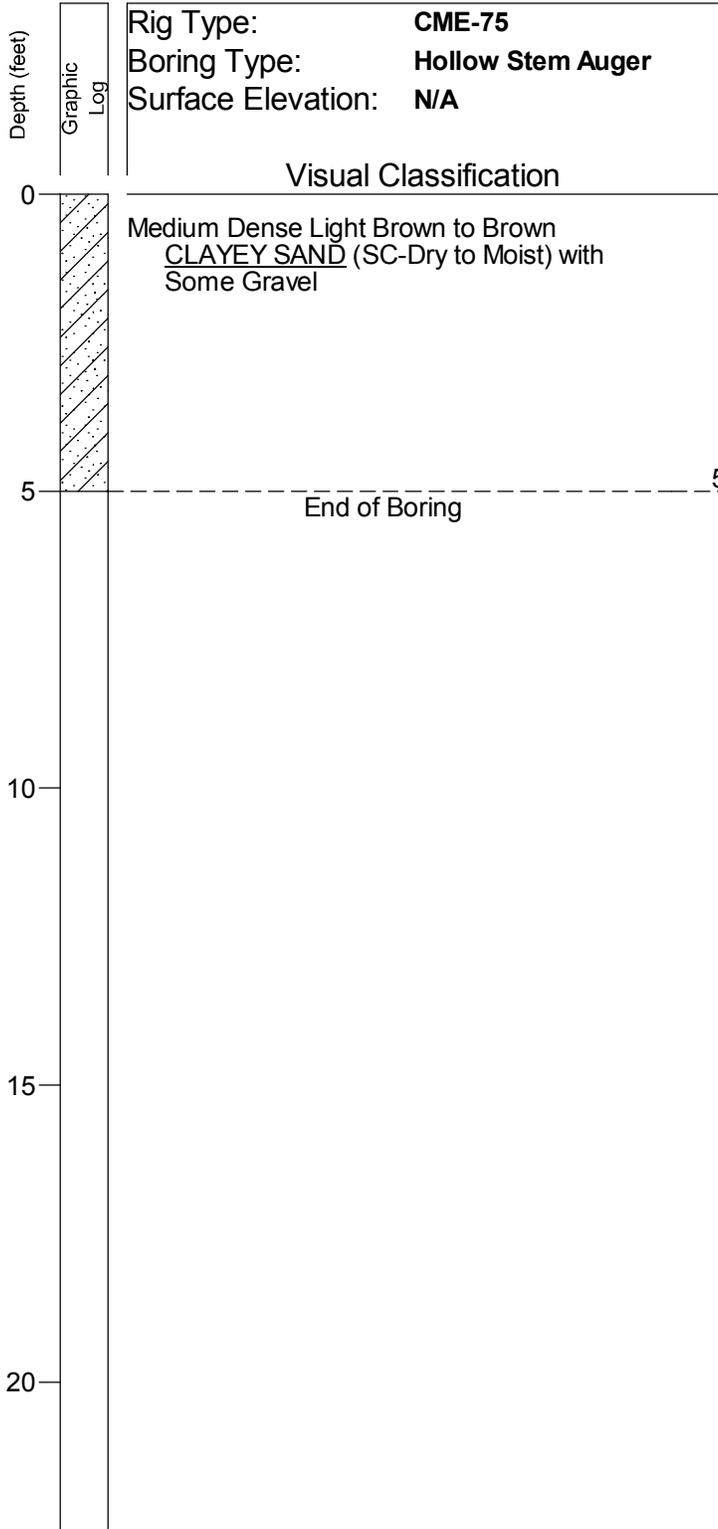
Log of Test Boring Number: **SG-1**

Buckeye Fire Station No 705

SEC Tartesso Parkway & Allyson Avenue

Buckeye, Arizona

Project No.: **1900095SA**



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
BS-1	3.0	NT	NT	

Boring Date: **1-21-19**
 Field Engineer/Technician: **R. Bainum**
 Driller: **J. Agular**
 Contractor: **Geomechanics SW**

Water Level		
Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **SG-2**

Buckeye Fire Station No 705

SEC Tartesso Parkway & Allyson Avenue

Buckeye, Arizona

Project No.: **1900095SA**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	RS-1	RING	1.0 - 2.0	5.7	86.1	42	65	85	90	100	31	19	12	SC	CLAYEY SAND
B-2	RS-1	RING	1.0 - 2.0	8.0	102.8	NT	NT	NT	NT	NT	NT	NT	NT	SC	CLAYEY SAND with GRAVEL
B-3	BS-4	SS	0.0 - 5.0	NT	NT	35	51	70	77	100	35	21	14	SC	CLAYEY SAND with GRAVEL
B-3	RS-1	RING	1.0 - 2.0	6.9	91.4	NT	NT	NT	NT	NT	NT	NT	NT	SC	CLAYEY SAND with GRAVEL
SG-1	BS-1	BULK	0.0 - 3.0	NT	NT	25	43	66	79	100	29	17	12	SC	CLAYEY SAND with GRAVEL

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested
Sheet 1 of 1

Buckeye Fire Station No 705
SEC Tartesso Parkway & Allyson Avenue
Buckeye, Arizona
Project No. 1900095SA



CONSOLIDATION TEST

PROJECT: Buckeye Fire Station No 705

PROJECT NO.: 1900095SA

LOCATION: SEC Tartesso Parkway & Allyson Avenue

DATE: 1/21/19

BORING NO.: B-1

SAMPLE NO.: RS-1

SAMPLE DEPTH: 1 to 2

LABORATORY NO.:

LIQUID LIMIT: 31

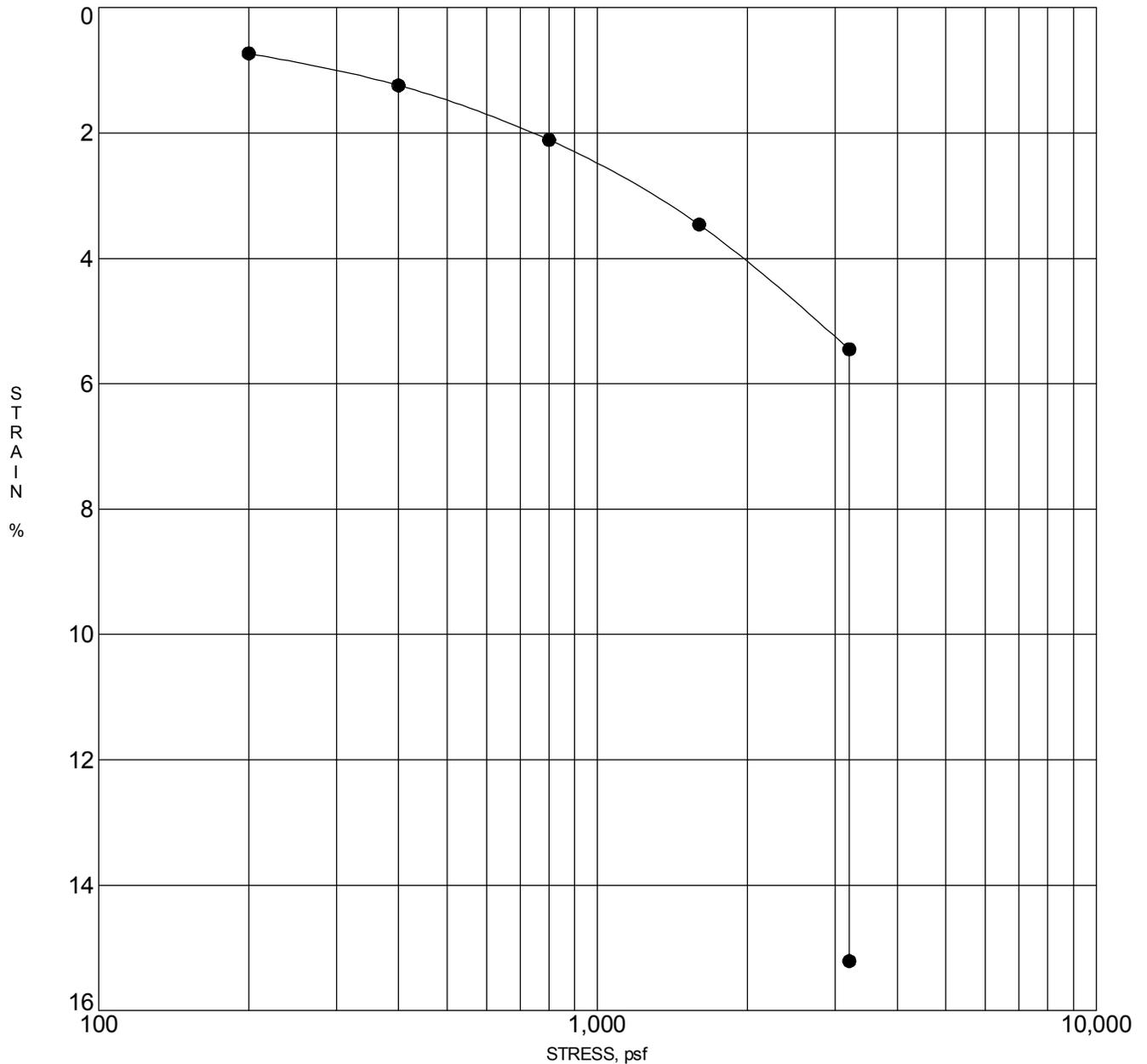
PLASTIC LIMIT: 19

PLASTICITY INDEX: 12

CLASSIFICATION: SC

ASTM SOIL DESCRIPTION:

CLAYEY SAND



Sample inundated at end of test at 3200 psf

**SPEEDIE
AND ASSOCIATES**

CONSOLIDATION TEST

PROJECT: Buckeye Fire Station No 705

PROJECT NO.: 1900095SA

LOCATION: SEC Tartesso Parkway & Allyson Avenue

DATE: 1/21/19

BORING NO.: B-2

SAMPLE NO.: RS-1

SAMPLE DEPTH: 1 to 2

LABORATORY NO.:

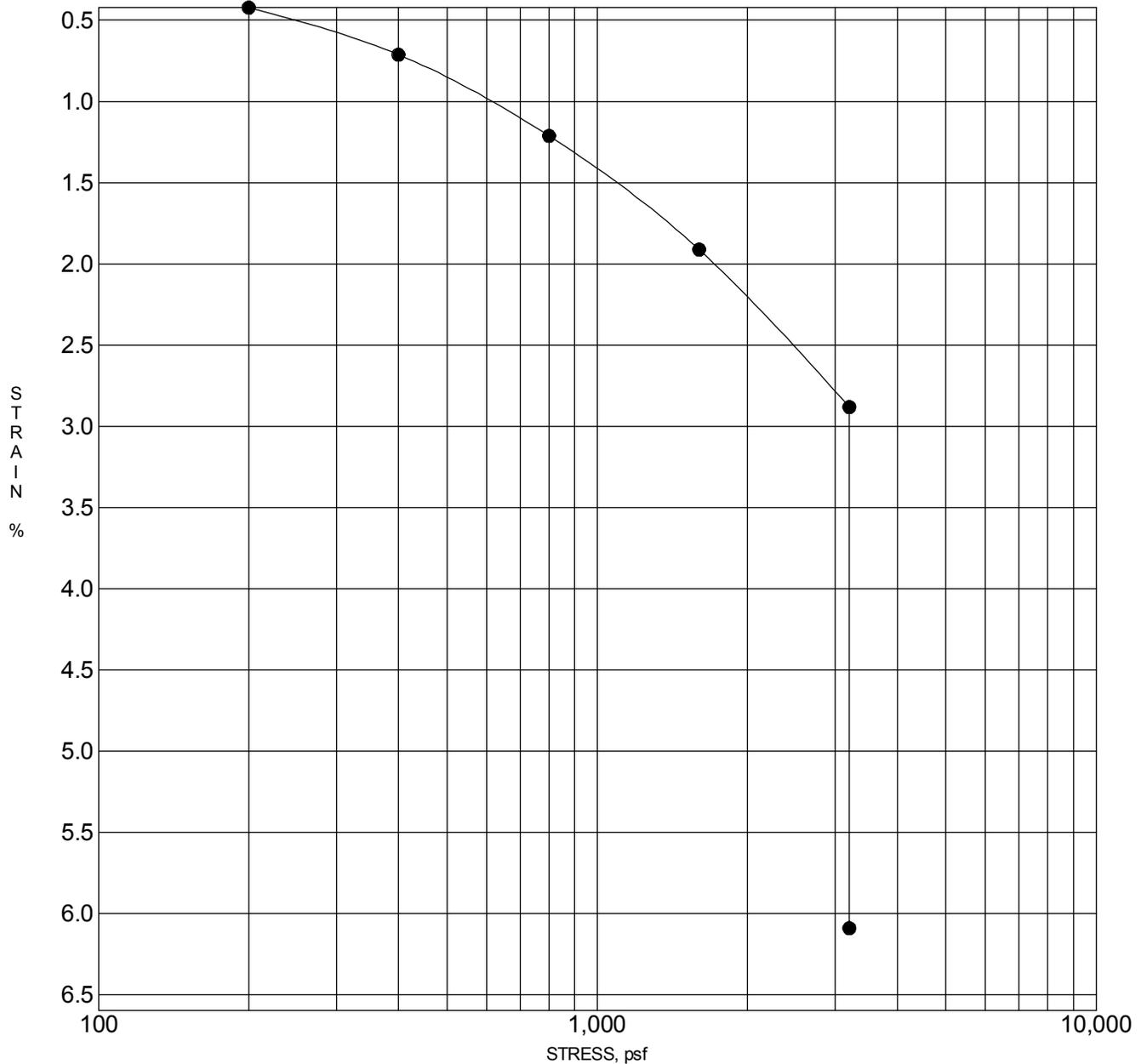
LIQUID LIMIT:

PLASTIC LIMIT:

PLASTICITY INDEX:

CLASSIFICATION:

ASTM SOIL DESCRIPTION:



Sample inundated at end of test at 3200 psf

**SPEEDIE
AND ASSOCIATES**

CONSOLIDATION TEST

PROJECT: Buckeye Fire Station No 705

PROJECT NO.: 1900095SA

LOCATION: SEC Tartesso Parkway & Allyson Avenue

DATE: 1/21/19

BORING NO.: B-3

SAMPLE NO.: RS-1

SAMPLE DEPTH: 1 to 2

LABORATORY NO.:

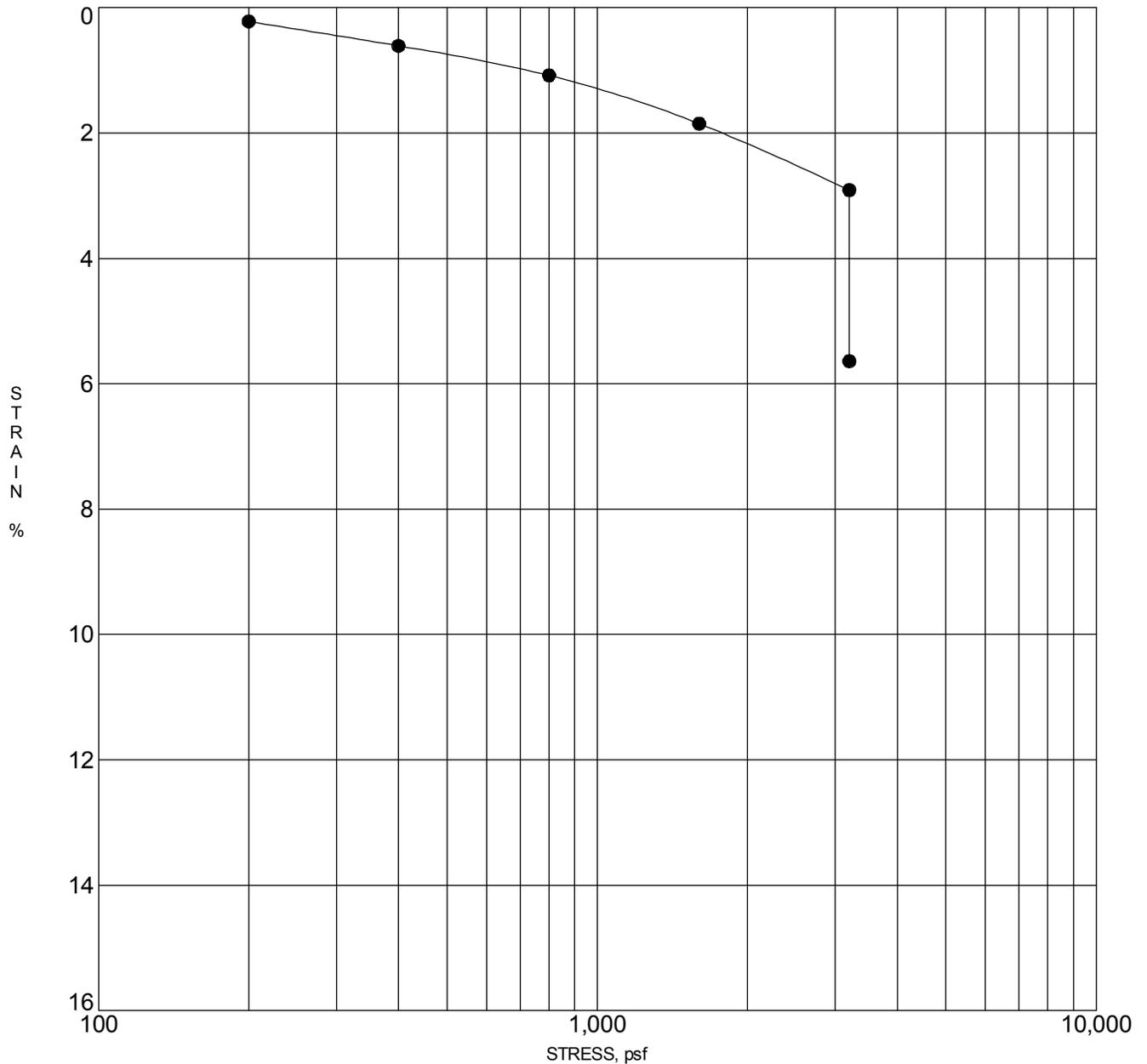
LIQUID LIMIT:

PLASTIC LIMIT:

PLASTICITY INDEX:

CLASSIFICATION:

ASTM SOIL DESCRIPTION:



Sample inundated at end of test at 3200 psf

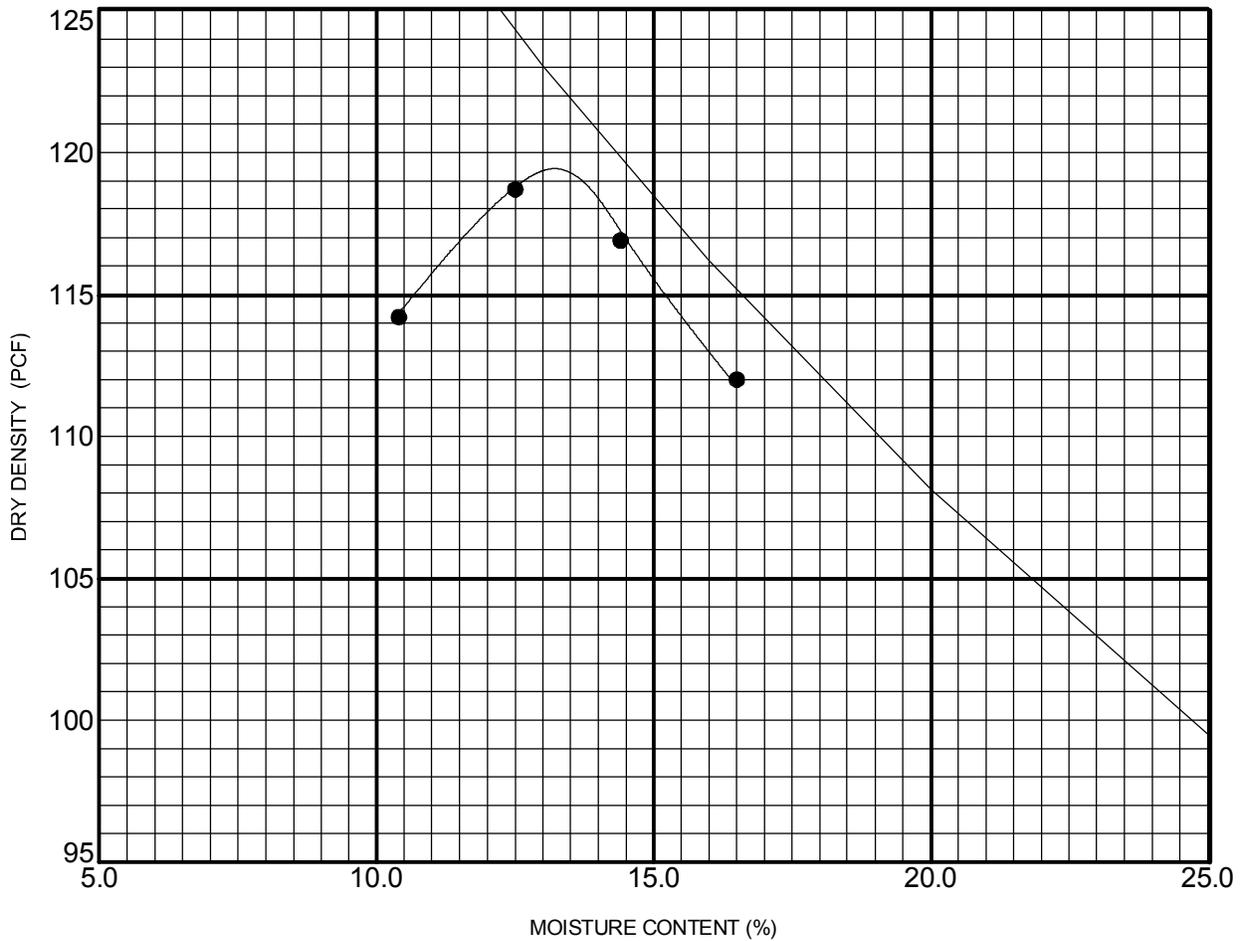
**SPEEDIE
AND ASSOCIATES**

MOISTURE-DENSITY RELATIONS

PROJECT: Buckeye Fire Station No 705 PROJECT NO.: 1900095SA
LOCATION: SEC Tartesso Parkway & Allyson Avenue DATE: 1/21/19
BORING NO.: B-3 SAMPLE NO.: BS-4 SAMPLE DEPTH: 0 to 5 LABORATORY NO.:
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 35 PLASTIC LIMIT: 21 PLASTICITY INDEX: 13
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND with GRAVEL

MAXIMUM DRY DENSITY: 119.3 PCF

OPTIMUM MOISTURE CONTENT: 13.1%



SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOVED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B-3, BS-4	5.0	119.3	13.1	113.9	10.8	95.5	17	100	2.4

Buckeye Fire Station No 705
 SEC Tartesso Parkway & Allyson Avenue
 Buckeye, Arizona
 Project No. 1900095SA



DOCUMENT 00 63 13

REQUEST FOR INTERPRETATION FORM

Project: Buckeye Fire Station No. 705 R.F.I. Number: _____
From: _____
To: Perlman Architects of Arizona, Inc. Date: _____
4808 North 24th Street, Suite 100
Phoenix, Arizona 85016 A/E Project Number: 318009

Specification Section: Paragraph: Drawing Reference: Detail

Request:

* Requested Date/Time for Response:

Signed by:

Response:

Attachments

Response From: To: * Date Rec'd: * Date Ret'd:

Signed by:

Copies: Owner Consultants _____ _____ _____ File

* Contractor shall allow up to 5 working days review and response time for RFI'S, unless review is required of multiple consultants, then the review and response period shall be 7 working days. (See Section 01 26 13.

SECTION 00 63 25

**SUBSTITUTION REQUEST
(After the Bidding Phase)**

Project: Buckeye Fire Station No. 705 Substitution Request Number: _____
From: _____
To: Perlman Architects of Arizona, Inc. Date: _____
4808 North 24th Street, Suite 100
Phoenix, Arizona 85016 A/E Project Number: 318009
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____
History: New product 2-5 years old 5-10 years old More than 10 years old
Differences between proposed substitution and specified product: _____

 Point-by point comparative data attached – REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:
Project: _____ Architect: _____
Address: _____ Owner: _____
Date Installed: _____

Proposed substitution affects other parts of Work: No Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).
Proposed substitution changes Contract Time: No Yes [Add] [Deduct] _____ days.

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

- Substitution approved – Make submittals in accordance with Specification Section 01 33 00.
- Substitution approved as noted – Make submittals in accordance with Specification Section 01 33 00.
- Substitution rejected – Use specified materials.
- Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: Contractor Subcontractor Supplier Manufacturer A/E _____

SECTION 01 11 00

SUMMARY OF WORK

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project: Project consists of a new single story, 3-Apparatus Bay Fire Station of approximately 13,239 sq. ft. located in the Tartesso subdivision at 30551 W. Tartesso Parkway, Buckeye, Arizona.
- B. Base Bid: The bid shall include labor, material, equipment, services and transportation necessary for the construction of the Project.

1.02 DEFINITIONS PERTAINING TO THE CONTRACT DOCUMENTS

- A. Furnish: To purchase and deliver.
- B. Install: To place into final position and connect.
- C. Provide: To furnish and install.
- D. Connect: To make the complete necessary utility connection (water, sewer, gas, electricity, etc.) from the building utility to the piece of equipment to allow that piece of equipment to function as intended (e.g., a gas connection for an oven or cooktop).
- E. "As shown", "as detailed", "as indicated" or words of similar import mean as indicated on the drawings
- F. "As selected", "as approved" or words of similar import mean as selected by, as approved by, or as accepted by the Architect and Owner.
- G. "Approved equal", "or equal" shall mean as approved and accepted by the Architect and Owner.
- H. "Shall" means mandatory.
- I. "As required" means as required by the contract documents.
- J. "As necessary" means essential to the completion of the work.
- K. "Concealed" means not visible in the finished work.
- L. "Exposed" means visible in the finished work.
- M. "Days" means calendar days.
- N. "Working Days" means work days and does not include legal holidays.
- O. Substantial Completion: That stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

1.03 CONTRACTOR USE OF SITE

- A. General: Contractor shall have full use of the site within Contract Limit Lines indicated for construction operations during the construction period.
- B. Construction Operations: Limited to areas noted on Drawings including storage of materials and equipment.
- C. Utility Outages and Shutdown: Interruption of utility services to the existing building(s) is not permitted.
- D. Smoking Restrictions: Smoking is not permitted within the building during and after construction or within 25 feet of entrances, operable windows, or outdoor air intakes.

1.04 PERMITS, FEES AND NOTICES

- A. Plan check fees have been paid by the Owner.
- B. The Contractor shall secure and pay for the building permit and for other permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received or negotiations concluded. This shall include, but not be limited to:
 - 1. Building Permit from the City of Buckeye, Arizona.
 - 2. Inspections and Certificates from State Fire Marshal.
 - 3. Other Permits as may be imposed by agencies having authority.
- C. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.
- D. It is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Architect and Owner in writing, and any necessary changes shall be accomplished by appropriate Modification.
- E. If the Contractor performs Work knowing it to be contrary to such laws, ordinances, rules and regulations, including, but not limited to the following, and without such notice to the Architect and Owner, the Contractor shall assume full responsibility therefore and shall bear attributable costs. Work shall comply with the following:
 - 1. Codes, Ordinances, Rules and Regulations, as adopted:
 - a. 2012 International Building Code (IBC)
 - b. 2012 International Fire Code (IFC)
 - c. 2012 International Mechanical Code (IMC)
 - d. 2012 International Plumbing Code (IPC)
 - e. 2011 National Electrical Code (NEC)
 - f. 2012 International Fuel Gas Code (IFGC)
 - g. 2012 International Energy Conservation Code (IECC)
 - h. ICC/ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities" (includes ramp slopes, mounting heights, wheelchair clearances, door clearances, slip resistance for floors, stairs and ramps, opening/operating force for doors, sill heights, etc.)
 - i. 2010 ADA Standards for Accessible Design.
 - 2. Contractor shall maintain current copies of each of the codes listed above on-site and available for use at the Contractors field office.

1.05 SPECIAL SITE CONDITIONS

- A. The Contractor shall be completely responsible for protecting existing site and street improvements, including utilities indicated to remain and adjacent to new construction from damage and/or injury due to this Work and shall repair at his expense and to the Architect's satisfaction, all areas damaged as a result of his Work.

1.06 ARCHITECTURAL BARRIERS

- A. It is the desire of the Owner that the facilities and improvements constructed under this Contract meet or exceed the intent of applicable public law concerning prohibition of discrimination, and that no individual be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of this completed Project.
- B. The designers and drafters of these Documents have intended to incorporate those Owner's intentions into these Documents.
- C. It is recognized that there may be products not incorporated into these Documents that may more nearly meet the Owner's desires than those included.
- D. The Owner hereby solicits those providing elements of this Project to bid and contract for the Project as required by these Documents, but at the time of submitting Shop Drawings, or sooner when appropriate, and without causing delay in the Project, to also submit proposals for improving the accessibility of the Project to physically or mentally impaired persons.

1.07 REPRODUCTION OF DRAWINGS

- A. Contractor shall not alter the size of Drawings when making or ordering reproductions.
- B. Only full-size, current Drawings shall be maintained at the Project Site.

1.08 COMMUNICATIONS

- A. All communications with the Architect shall be copied to the Owner's Representative.
- B. All communications with the Architect's consultants shall be through the Architect.

END OF SECTION

SECTION 01 26 13

REQUESTS FOR INTERPRETATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Administrative requirements for requests for information / interpretation.

1.02 DEFINITIONS

- A. Request For Information / Interpretation (RFI):
1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
 2. A properly prepared request for information / interpretation shall include a detailed written statement that indicates the specific Drawings or Specification in need of clarification and the nature of the clarification requested.
 - a. Drawings shall be identified by drawing number and location on the drawing sheet.
 - b. Specifications shall be identified by Section number, page and paragraph.
 3. Requests for Information: Request made by Contractor concerning items not indicated on Drawings or contained in the Project Manual that is necessary to properly perform the Work.
 4. Requests for Interpretation: Request made by Contractor in accordance with Owner's Representative's third party obligations to the contract for construction.
- B. Improper RFI's:
1. RFI's that are not properly prepared.
 2. Improper RFI's will be processed by the Architect at the Architect's standard hourly rate and Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Contractor will be notified by the Architect prior to the processing of improper RFI's.
- C. Frivolous RFI's:
1. RFI's that request information that is clearly shown on the Contract Documents.
 2. Frivolous RFI's may be returned unanswered or may be processed by the Architect at the Architect's standard hourly rate and Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Contractor will be notified by the Architect prior to the processing of frivolous RFI's.

1.03 CONTRACTOR'S REQUESTS FOR INFORMATION

- A. RFI's shall be submitted on Document 00 63 13 included in the Project Manual, or similar form prepared by the Contractor and approved by the Architect prior to use.
1. Forms shall be completely filled in, and if prepared by hand, shall be fully legible.
 2. RFI's shall be submitted in numerical order with no breaks in the consecutive numbering.
 3. Each page of attachments to RFI's shall bear the RFI number and shall be consecutively numbered in chronological order.

4. RFI's shall be submitted by E-Mail or digital file transfer.
 - a. Address for E-Mail will be distributed by the Architect at the Pre-Construction Conference.
 - b. An electronic version of Document 00 63 13 will be provided upon request.
- B. When the Contractor is unable to determine from the Contract Documents, the material, process or system to be installed, the Architect shall be requested to make a clarification of the indeterminate item.
 1. Whenever possible, such clarification shall be requested at the next appropriate Project Meeting, with the response entered into the meeting minutes. When clarification at the meeting is not possible, either because of the urgency of the need, or the complexity of the item, Contractor shall prepare and submit an RFI to the Architect.
 2. RFI's may not be sent directly to the Architect's Consultants. All RFI's shall be sent directly to the Architect.
- C. Contractor shall endeavor to keep the number of RFI's to a minimum. In the event that the process becomes unwieldy, in the opinion of the Architect, because of the number and frequency of RFI's submitted, the Architect may require the Contractor to abandon the process and submit future requests as either submittals, substitutions or requests for change.
- D. RFI's shall be originated by the Contractor.
 1. RFI's from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by the Contractor prior to submittal to the Architect.
 2. RFI's from subcontractors or material suppliers sent directly to the Owner's Representative, Architect or the Architect's consultants shall not be accepted and will be returned unanswered.
- E. Contractor shall carefully study the Contract Documents to assure that the requested information is not available therein. RFI's which request information available in the Contract Documents will be deemed either "improper" or "frivolous" as noted above.
- F. In cases where RFI's are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically, and similar items, the Contractor shall fully lay out a suggested solution using drawings or sketches drawn to scale, and submit same with the RFI. RFI's which fail to include a suggested solution will be returned unanswered with a requirement that the Contractor submit a complete request.
- G. RFI's shall not be used for the following purposes:
 1. To request approval of submittals
 2. To request approval of substitutions,
 3. To request changes which are known to entail additional cost or credit. (A Change Order Request form shall be used.)
 4. To request different methods of performing work than those drawn and specified.
- H. In the event the Contractor believes that an RFI response by the Architect results in additional cost or time, Contractor shall not proceed with the work indicated by the RFI until a Change Order (or Construction Change Directive, if applicable to the Project) is prepared and approved. RFI's shall not automatically justify a cost increase in the work or a change in the Project schedule.
 1. Answered RFI's shall not be construed as approval to perform extra work.
 2. Unanswered RFI's will be returned with a stamp or notation "Not Reviewed".

- I. Contractor shall prepare and maintain a log of RFI'S, and at any time requested by the Architect, Contractor shall furnish copies of the log showing outstanding RFI'S. Contractor shall note unanswered RFI's in the log.
- J. Contractor shall allow up to 5 working days review and response time for RFI'S, unless review is required of multiple consultants, then the review and response period shall be 7 working days.
 - 1. The Architect will endeavor to respond to RFI's in a timely manner.
 - 2. RFI shall state requested date/time for response, however, this requested date/time for response is not a guarantee that the RFI will be answered by that date/time if that date/time is too expeditious.
 - 3. Architect may request additional time when deemed necessary.

1.04 ARCHITECT'S RESPONSE TO RFI'S

- A. Architect will respond to RFI's on one of the following forms:
 - 1. Answers to properly prepared RFI's will be made directly upon the RFI form and will be returned via E-Mail or digital file transfer.
 - 2. Improper or Frivolous RFI's
 - a. Notification of Processing Fee(s).
 - b. Unanswered RFI's will be returned with a stamp or notation: "Not Reviewed."
- B. Architect may opt to retain RFI's for discussion during regularly scheduled project meetings for inclusion of responses in meeting minutes in lieu of responding on a written form.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

1.01 SCHEDULE OF VALUES

- A. With first Application for Payment, submit three (3) copies of completed AIA Document G703 Continuation Sheet indicating the scheduled value of major categories and subcontracts for the Work, for approval of the Architect.
- B. For each item, provide a column for listing:
 - 1. Item number
 - 2. Description of Work
 - 3. Scheduled Value
 - 4. Previous Applications
 - 5. Work in Place and Stored Materials under this Application
 - 6. Authorized Change Orders
 - 7. Total Completed and Stored to Date of Application
 - 8. Percentage of Completion
 - 9. Balance to Finish
 - 10. Retainage.

1.02 PAY REQUEST

- A. The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by approved AIA Document G703, Continuation Sheet. A minimum of three (3) original copies of these forms shall be submitted for each application. Submit additional copies if requested by the Owner or Architect.
 - 1. Present required information in typewritten form or on electronic media printout.
 - 2. Execute certification by signature of authorized officer.
 - 3. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 - 4. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.
- B. With each Application for Payment submit lien releases for the previous payment, substantiation for stored materials, monthly progress reports and updates, and any other pertinent items required by the Owner or Architect and identified during the Pre-Construction Conference.
 - 1. AIA Documents G706, Contractor's Affidavit of Payment of Debts and Claims, G706-A, Contractor's Affidavit of Release of Liens, Documents G707, Consent of Surety Company to Final Payment shall be used.
 - 2. If appropriate, G707-A, Consent of Surety to Reduction in or Partial Release of Retainage shall be used.
- C. When acceptable to the Owner, the Contractor may submit for payment on properly stored materials not yet incorporated into the work. Materials stored on the site must be in a secured area and be protected from damage, weather, theft or vandalism. The Contractor shall be responsible for replacing any damaged or missing materials.
- D. Materials stored off the job site must be in the supplier's storage area, separated from other materials, and clearly labeled for this particular project. Insurance certificates for the material naming the Owner as an additional insured, loss payee shall be delivered with the pay request.

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

- A. A Preconstruction Conference to discuss the Project work will be held at a time and location designated by the Architect.
- B. Contractor, and representatives of major Subcontractors, shall meet with Owner and Architect. The purpose of this conference is to discuss the Project in detail, including scheduling of Work, and to answer questions. Unless followed up in writing, verbal authorizations or acknowledgement of those present are not binding.
- C. Meeting minutes will be taken by the Contractor for distribution to all attendees within 48 hours of conference.

1.02 PROGRESS MEETINGS

- A. At day and time designated by the Architect, Progress Meetings will be held at Project site.
- B. Contractor and representatives of major Subcontractors shall meet with Owner and Architect.
- C. Contractor is responsible for notifying Subcontractors of their required attendance. These meetings will address progress of the Work and problems that may have developed since the previous meeting.
- D. Unless followed up in writing, verbal authorizations or acknowledgements by those present are not binding.
- E. Meeting minutes will be taken by the Contractor for distribution to all attendees within 48 hours of each meeting.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 CONSTRUCTION SCHEDULE

- A. Submit 3 copies of the Construction Schedule, broken down by Trade or Material, to the Architect for approval prior to the first Pay Request. Schedule shall be by CPM or bar graph type, and shall show proposed starting and completion dates for each Trade and activity for the Work. Submit 3 copies of updated schedule at each Pay Request field review to the Architect.
- B. Submit completed construction schedule to Architect no later than 15 calendar days after date of Agreement and update monthly during construction. Submit current schedule with each application for payment.
- C. Submit completed material delivery schedule to the Architect no later than 20 calendar days after the date of the Agreement. Identify material critical to the progress of the Project and those for which long lead time in procurement is anticipated. Indicate projected dates for submittal, order and delivery of such material.

1.02 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- A. Submit the completed schedule of submittals to the Architect no later than 15 calendar days after date of Agreement and update monthly during construction. Submit current schedule with each application for payment.
- B. Shop Drawings:
 - 1. Following Contractor's review and approval, submit to the Architect three black on white prints of each Drawing for review.
 - 2. The Architect will review the Drawings and affix a stamp to the indicating the findings of the review, and will return same to the Contractor.
 - 3. Comments, if any, will be noted directly on the drawing.
 - 4. The Contractor shall then print and distribute the appropriate number of copies to the various Trades and to Contractor's job personnel as required.
 - 5. If a drawing is indicated to be corrected and resubmitted, correct and resubmit as outlined above.
 - 6. Fire Alarm System/Fire Sprinklers System Shop Drawings shall be submitted to the state and local Fire Marshal and obtain approval prior to installation. Fire Marshal inspection, test and approval of completed installations shall be obtained prior to acceptance of the systems and Substantial Completion of the Project.
- C. Product Data:
 - 1. Following Contractor's review and approval, submit to the Architect four (4) copies of Manufacturer's catalogs and brochures, or PDF format electronic copy of Manufacturer's catalogs and brochures as required by the Specifications. If electronic copy product data are furnished, all files shall be full size PDF only. Resubmit corrected copies for approval in accordance with original submittal.
- D. Samples:
 - 1. Following Contractor's review and approval, submit to the Architect samples of materials in quantities and sizes as required by the Specifications. No electronic copy of samples will be considered for review.

2. Submit a minimum of four (4) samples of each required material, one each for Architect, Owner, Contractor and Subcontractor.
 3. Submittals required other than for selection of color, texture, fabric or finish shall be given to the Architect at a time determined by the Contractor, which will allow for resubmittal and which will not cause and delay in the Work.
 4. Corrected samples shall be resubmitted for approval as per the original submittal.
- E. Color Selection: Within 30 days of the date of Agreement, submit to the Architect for approval, samples and appropriate information required for the selection of colors, textures, fabric and finishes for the entire Project. Physical samples shall be submitted for color or material selections. Electronic samples will not be reviewed. Final selection of color, textures, fabrics or finishes will not be made until all applicable and related submittals have been provided. If the Contractor fails to provide the required samples and related information within the time period, the Architect shall have the option of selecting colors, textures, fabric, finishes or specific materials from those specified or approved and the Contractor shall be obligated to provide the material selected by the Architect.
- F. As identified on the Drawings and/or the Specifications, construct and submit a full scale, full construction mock-up assembly located at the site and per Owner's instructions. Wherever possible, the mock-up shall be utilized or incorporated into the final construction.
- G. Submit Shop Drawings, Product Data and Samples for only those items specifically mentioned in the Specifications and or Addenda. Contractor shall be responsible for obtaining Shop Drawings required for the progress of the Work, even though such Shop Drawings may not require the Architect's review.
- H. Partial Submittals: Submittals which are partial or contain only a portion of the data required to describe the item or installation will be rejected, unless such partial submittal is coordinated with the Architect prior to submittal, and final approval of all such items will be withheld pending receipt of all required information.
- I. Deviations: All deviations from the Contract Documents shall be clearly identified in the submittal. Submittal shall include only items included in the specifications or which have been approved in advance by the Architect in accordance with requirements of Section 01600. Submittals containing items which have not been approved in advance by the Architect will be rejected.

1.03 QUALITY CONTROL SUBMITTALS

- A. Equipment Lists: Following Contractor's review and approval, submit to the Architect 6 complete lists of major items of mechanical, plumbing and electrical equipment and materials, within 30 calendar days after date of Agreement. Submit all items at one time. Partial list will not be acceptable. Submittals shall include the Manufacturer's Specifications, weights, space requirements, physical dimensions, rating of equipment and supplemental information requested by the Architect. Submit performance curves for pumps and fans. Where a submittal sheet describes items in addition to that item being submitted, delete such items. Clearly note equipment and materials which deviate from those shown or specified in size, weight, required clearances, and location of access. Modifications to the Work as shown or specified in submittals shall be indicated and shall be provided by the Contractor as a part of the Work.
- B. Manufacturer's Instructions: Where Specifications require Work to be furnished, installed or performed in accordance with a specified product Manufacturer's instructions, distribute copies of such instructions to concerned parties.

1.04 REVIEW PROCESS

- A. All Shop Drawings will be reviewed and returned within 7 working days to the Contractor for distribution to the applicable trades. Shop Drawings for major components of the Work (i.e. Structural Steel) shall be returned within 14 working days.
- B. Shop Drawings are to be submitted to the Architect in a reasonable sequenced manner as not to overburden the reviewing discipline. If the Architect feels as though the review of the Submittal is not on the critical path of the Project, then the review may exceed indicated review times.
- C. If the corrections identified on the Shop Drawings are not corrected and the review of the same Submittal exceeds two (2) reviews, the Contractor will be billed for additional reviews at the current hourly rate charged by the Architect or his Consultants. This process will require that the Contractor be notified of the charges and an additional Service Work Order be signed prior to the review commencing.

END OF SECTION

SECTION 01 42 00

REFERENCES

1.01 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes. Such Reference Standards are made part of the Contract Documents by reference.
- B. Conform to reference standard by date of issue current on date of Contract Documents.
- C. Obtain copies of standards when required by Contract Documents.
- D. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.02 SCHEDULE OF REFERENCES

- A. The following is a partial list of agencies, councils, institutions, associations, and so forth that may be referred to in the Contract Documents. This list is not to be interpreted as being complete.

AA	Aluminum Association	www.aluminum.org
AABC	Associated Air Balance Council	www.aabchq.com
AAMA	American Architectural Manufacturers Association	www.aamanet.org
AASHTO	American Association of State Highway	www.aashto.org
ACI	American Concrete Institute	www.aci-int.org
ADC	Air Diffusion Council	www.flexibleduct.org
AFPA	American Forest and Paper Association	www.afandpa.org
AI	Asphalt Institute	www.asphaltinstitute.org
AIA	American Institute of Architects	www.aia.org
AISC	American Institute of Steel Construction	www.aisc.org
AISI	American Iron and Steel Institute	www.steel.org
AITC	American Institute of Timber Construction	www.aitc-glulam.org
AMCA	Air Movement and Control Association	www.amca.org
AMG	Arizona Masonry Guild	www.masonryforlife.com
ANSI	American National Standards Institute	www.ansi.org

APA	Engineered Wood Association	www.apawood.org
API	American Petroleum Institute	www.api.org
ARI	Air-Conditioning and Refrigeration Institute	www.ari.org
ASHRAE	American Society of Heating, Refrigerating	www.ashrae.org
ASME	American Society of Mechanical Engineers	www.asme.org
ASTM	American Society for Testing and Materials	www.astm.org
AWI	Architectural Woodwork Institute	www.awinet.org
AWPA	American Wood Preservers Association	www.awpa.com
AWS	American Welding Society	www.aws.org
AWWA	American Water Works Association	www.awwa.org
BHMA	Builders Hardware Manufacturer's Association	www.buildershardware.com
BIA	Brick Industry Association	www.brickinfo.org
CDA	Copper Development Association	www.copper.org
CISCA	Ceilings and Interior Systems Construction Association	www.cisca.org
CLFMI	Chain Link Fence Manufacturers Institute	www.chainlinkinfo.org
CRI	The Carpet and Rug Institute	www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute	www.crsi.org
CSSB	Cedar Shingle and Shake Bureau	www.cedarbureau.org
DHI	Door and Hardware Institute	www.dhi.org
EJMA	Expansion Joint Manufacturers Association	www.ejma.org
FMG	FM Global	www.allendale.com
GA	Gypsum Association	www.gypsum.org
GANA	Glass Association of North America	www.glasswebsite.com
ICC	International Code Council	http://www.iccsafe.org/
IEEE	Institute of Electrical and Electronics Engineers	www.ieee.org
IGMA	Insulating Glass Manufacturers Alliance	www.igmaonline.org
MAG	Maricopa Association of Governments	www.mag.maricopa.gov
MBMA	Metal Building Manufacturer's Association	www.mbma.com

MIL	Military Specification	http://dodssp.daps.dla.mil/
ML/SFA	Metal Lath/Steel Framing Association	www.naamm.org
NAAMM	National Association of Architectural	www.naamm.org
NCMA	National Concrete Masonry Association	www.ncma.org
NEBB	National Environmental Balancing Bureau	www.nebb.org
NEMA	National Electrical Manufacturers Association	www.nema.org
NFPA	National Fire Protection Association	www.nfpa.org
NRCA	National Roofing Contractors Association	www.nrca.net
NTMA	National Terrazzo and Mosaic Association	www.ntma.com
PCA	Portland Cement Association	www.cement.org
PCI	Precast/Prestressed Concrete Institute	www.pci.org
PDCA	Painting and Decorating Contractors of America	www.pdca.com
PS	Product Standard U. S. Department of Commerce	http://ts.nist.gov/Standards/Conformity/sccg.cfm
RIS	Redwood Inspection Service	www.redwoodinspection.com
RFCI	Resilient Floor Covering Institute	www.rfci.com
SDI	Steel Deck Institute	www.sdi.org
SDI	Steel Door Institute	www.steeldoor.org
SIGMA	Sealed Insulating Glass Manufacturers Association	Refer to IGMA
SJI	Steel Joist Institute	www.steeljoist.org
SMACNA	Sheet Metal and Air Conditioning	www.smacna.org
SSPC	The Society for Protective Coatings	www.sspc.org
TCA	Tile Council of America, Inc.	www.tileusa.com
UL	Underwriters' Laboratories, Inc.	www.ul.com
WCLIB	West Coast Lumber Inspection Bureau	www.wclib.org
WDMA	Window and Door Manufacturing Association	www.wdma.com
WWPA	Western Wood Products Association	www.wwpa.org

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.01 TESTING LABORATORY SERVICES

- A. Special Inspections and Testing: Owner will employ and pay for the services of an independent testing agency to perform Special Inspections and Testing called for in the Contract Documents and as required by Code or authorities having jurisdiction.
- B. Quality Control Testing and Inspections: Contractor shall retain an independent testing laboratory, acceptable to Architect and Owner, to perform quality control testing Work called for in the Contract Documents, and pay cost of services.
- C. Contractor shall cooperate with Testing Laboratory personnel and provide access to the Work as required to perform testing or inspections called for in the Construction Documents.
- D. Contractor shall furnish samples for such tests and deliver them to the Testing Laboratory in quantities as required by the Contract Documents.
- E. Contractor shall provide Testing Laboratory 24 hours minimum notice in advance of Work being performed that requires testing and/or inspection services.
- F. The Testing Laboratory(s) shall, within 24 hours of performing a test or inspection, distribute digital copies of reports as follows:
 - 1. Architect
 - 2. Structural Engineer or other Engineering Consultant
 - 3. Contractor
 - 4. Code authorities or authorities having jurisdiction as they may require.
- G. All costs for additional inspections and/or retesting required when initial testing indicates Work does not comply with Contract Documents, shall be paid for by the Contractor.
- H. Refer to individual specification Sections and General Notes on Drawings for specific requirements for Testing and/or Inspections. The following lists are intended as a guide to the Contractor to aid in determining testing requirements for the Project, however, the requirements specified in the Technical Sections shall take precedence over these lists and these lists are not to be interpreted as being complete.
 - 1. Special Inspections and Testing:
 - a. Special Inspections and Testing required by the General Structural Notes on the Drawings.
 - b. 03 30 00 - Cast-In-Place Concrete: Test cylinders, slump test(s)
 - c. 04 05 15 - Mortar and Masonry Grout: Test of grout mix
 - d. 04 22 00 - Concrete Unit Masonry: Prism testing
 - e. 05 10 00 - Structural Steel Framing: Welded connection tests, inspection of high strength bolts.
 - f. 31 00 00 - Earthwork: Test imported fill materials if required, observation of earthwork by Geotechnical Engineer, density and moisture testing of trench backfill, field density tests of underslab fill and backfill.
 - g. 31 31 00 – Soil Treatment: Field test termite treatment.

2. Quality Control Testing and Inspections:
 - a. 03 30 00 - Cast-In-Place Concrete: Floor flatness, calcium chloride moisture testing.
 - b. 07 92 00 – Joint Sealers: Field adhesion testing and stain testing.
 - c. 09 65 60 – Resilient Athletic Flooring: Moisture content of concrete sub-floors.
 - d. 31 31 00 – Soil Treatment: Field test termite treatment.
 - e. 32 12 16 - Asphaltic Concrete Paving: Smoothness tests

1.02 CONTRACTOR'S QUALITY CONTROL

- A. Where Contract Documents require that a particular product be installed and/or applied by an applicator approved by the Manufacturer, it is the Contractor's responsibility to ensure that the subcontractor employed for such work is approved in writing by the Manufacturer of the product. Such subcontractor(s) shall provide evidence of being approved to the Owner and Architect prior to being awarded the Subcontract for the Work.
- B. Work shall be executed by persons skilled in the work required and shall conform to the highest methods, standards and accepted practices of the Trade or Trades involved.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 GENERAL

- A. Comply with codes and regulations regarding potable drinking water, sanitation, dust control, fire protection, and other temporary controls.
- B. Remove temporary office facilities (construction trailers), toilets, storage sheds and other construction of temporary nature from the site as soon as, in the opinion of the Architect, the progress of the work will permit. Recondition and restore to a condition acceptable to the Architect, areas of the site occupied by temporary facilities.
- C. Obtain written approval from the Owner a minimum of 72 hours prior to disconnection or shutting off service or utility.

1.02 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required from Utility and make arrangements for such service.
- B. Provide temporary electric feeder from electrical service at location as directed by the Utility Owner or as indicated on Drawings.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as necessary.
- D. Provide main service disconnect and overcurrent protection at convenient location.
- E. Permanent convenience receptacles may be utilized during construction after appropriate approvals and permits for temporary use. Existing electrical receptacle used during construction shall be left in a new condition without damage at final completion.
- F. Provide adequate distribution equipment, wiring, and outlets to provide branch circuits for power and lighting.

1.03 TEMPORARY LIGHTING

- A. Provide incandescent lighting for construction operations to achieve a minimum lighting level of 2 watts/sq. ft.
- B. Provide adequate floodlights, clusters and spot illumination to work areas after dark.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- D. Maintain lighting and provide routine repairs.
- E. Replace all lamps used during the construction period immediately prior to issuance of Certificate of Substantial Completion.

1.04 TEMPORARY HEATING/COOLING AND VENTILATING

- A. Provide and pay for heating/cooling devices and heat as required to maintain appropriate and specified conditions for construction operations. Exercise measures to conserve energy.
- B. Use of permanent HVAC equipment will not be allowed. HVAC equipment and ductwork will be covered during the construction process. Use temporary equipment to facilitate heating and cooling of the interior spaces.
- C. Maintain minimum/maximum ambient temperature and humidity conditions required by individual specification sections for installation of materials and finishes required to have specific environmental conditions.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.05 COMMUNICATIONS

- A. At time of Project mobilization, or before, provide Architect and Owner with Project team directory, including the following:
 - 1. General Contractor's home office.
 - 2. Contractor's superintendant mobile telephone number.
 - 3. Other major subcontractors and Project Team members.
- B. Provide superintendant with mobile telephone throughout construction period.
- C. Computer and Internet Access: Provide computer with internet access in field office.
 - 1. Provide DSL or Cable modem access with 1.5 Mbps minimum.
 - 2. Computer shall be made available to Owner and Architect for use throughout construction.
 - 3. Provide account/address reserved for project use.

1.06 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required for construction operations.
- B. Extend branch piping throughout the site to provide outlets for hoses with threaded connections.

1.07 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures.

1.08 TEMPORARY FIRE PROTECTION

- A. Provide adequate number of fire extinguishers to protect the Work.
- B. Comply with fire insurance and governing regulations.
- C. Provide UL labeled ABC all-purpose fire extinguishers adequate in size and number.
- D. Provide temporary office and storage areas with fire extinguishers.

1.09 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.
- C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.10 FENCING

- A. Construction: Commercial grade chain link fence with adequate support to remain in place during storm winds.
- B. Provide 6'-0" high fence around construction site, including new parking lot, contractor staging areas, landscape areas, retention areas, etc. as necessary to protect Work; equip with vehicular and pedestrian gates with locks.
- C. Locate gates for access to work areas, as required. Close and lock after working hours.

1.11 ENVIRONMENT PROTECTION AND CONTROLS

- A. Exercise controls to keep noise and dust during construction to a minimum. Traffic or construction areas shall be sprinkled with water or chemicals as required and in accordance with applicable regulatory requirements.
- B. Environmental Protection: Conduct construction operations and operate equipment and machinery using methods complying with environmental regulations to avoid or minimize pollution or contamination to air, water, waterways, soil, groundwater, or other natural resources.
 - 1. Air Resources: Prevent creation of dust, air pollution, and odors.
 - 2. Store volatile liquids, including fuels and solvents, in closed containers.
 - 3. Properly maintain equipment to reduce gaseous pollutant emissions.
 - 4. Properly dispose of hazardous or contaminated debris in compliance with environmental regulations.
 - 5. Grade site to drain. Maintain excavations free of water. Provide, operate and maintain pumping equipment as may be necessary.
 - 6. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
 - 7. Comply with local requirements for storm water pollution prevention.

1.12 EXTERIOR ENCLOSURES

- A. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.13 PROTECTION OF INSTALLED WORK

- A. Protect all installed work. Provide the special protection features where specified in individual specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to avoid damage.

- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with plywood sheets and waterproof covering.
- E. Prohibit traffic or storage directly on waterproofed or roofed surfaces. If traffic or activity is necessary, provide protection in accordance with material and or system manufacturer's printed instructions.
- F. Prohibit traffic from landscaped areas.

1.14 SECURITY

- A. Provide security and facilities to protect Work and existing facilities, and Owner's operations from unauthorized entry, vandalism or theft.
- B. Provide and pay for watchman service if necessary for adequate protection.

1.15 SITE ACCESS, PARKING AND STAGING

- A. Provide temporary surface parking areas to accommodate construction personnel.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide fenced are with secure locking gates for exterior construction staging that may be necessary throughout the construction period.

1.16 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition on a daily basis.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Regularly remove waste materials, debris, and rubbish from site and dispose off-site. Do not allow to accumulate.

1.17 PROJECT IDENTIFICATION

- A. Provide project sign as indicated on the Drawings of exterior grade plywood and wood frame construction, painted to Owner's design and colors.
 - 1. Provide with identification graphics as indicated on the Drawings.
 - 2. Erect on site at location established by Architect.
- B. Contractor shall obtain all required City of Buckeye approvals and sign permits and pay all fees required for installation of temporary construction signs.
- C. No other signs are allowed without Owner's permission except those required by law.

1.18 FIELD OFFICES AND SHEDS

- A. Offices (Construction Trailers): Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. Provide space for project meetings, with table and chairs to accommodate the entire Project Team.
- C. Locate offices (construction trailers) and sheds as approved by Owner.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DELIVERY, STORAGE AND HANDLING

- A. Deliver manufactured materials in original packages, containers or bundles, with the seals unbroken, identified by the name and mark of the Manufacturer, the product name, color, number, and so forth.
- B. Deliver fabrications in as large assemblies as practicable. Fabrications specified to be shop-primed or shop-finished shall be packaged or crated as required to preserve such priming or finish intact and free from damage.
- C. The Contractor shall be responsible for protecting all materials and equipment furnished under the Contract including materials and equipment furnished by the Owner for the Contractor to install and for the materials and equipment furnished and installed by the Owner's separate contractors in the completed or partially completed Work.
- D. Store materials in a manner to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt or other cause will not be acceptable and are to be removed from the site. Replace such materials immediately so as not to delay the Work.
- E. Store materials so as to cause no obstructions. Store off sidewalks, roadways, and underground services.
- F. When a room in the Project is used as a shop or store room, the Contractor shall be responsible for all repairs, patching or cleaning necessary due to such use. Location of such storage space shall be subject to approval of the Architect.

1.02 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. Whenever a product is specified by using a proprietary name or the name of a particular Manufacturer or Vendor, the specific item mentioned shall be understood as establishing type, function, dimension, appearance, and quality desired.
- B. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Architect to determine that products proposed are equivalent to those named.
- C. Prior Approvals:
 - 1. Substitutions will be considered when written request has been submitted to the Architect for approval.
 - 2. Contractor shall request approval of such substitution, in writing, to the Architect using Document 00 43 25 – Substitution Request (During the Bidding Phase) form contained in the Project Manual.
 - 3. Each such request shall include all information requested below for Requests for approval after award of a Contract. If the Owner approves any proposed substitution, such approval shall be set forth in an Addendum.

- D. Requests for approval after award of a Contract:
1. Requests shall be made only under one of the following conditions:
 - a. Specified product or material is not available.
 - b. Extensive revisions to the Contract Documents are not required.
 - c. Proposed changes are consistent with intent of the Contract Documents.
 - d. Request is timely and properly submitted.
 - e. Specified product or material cannot be provided within the Contract Time.
 - f. Request relates to an “or equal” clause.
 - g. Proposed substitution offers Owner a substantial advantage in cost, time, or other considerations.
 - h. Specified product or material cannot receive regulatory approval.
 - i. Specified product or material is incompatible with other materials.
 - j. Specified product or material cannot be coordinated with other materials.
 - k. Specified product or material manufacturer cannot provide the specified warranty.
 2. Requests shall be submitted to the Architect a minimum of 10 working days prior to date Contractor is required to place an order for the product.
 3. Contractor shall request approval of such substitution, in writing, to the Architect using Section 00 63 25 – Substitution Request (After the Bidding Phase) form contained in the Project Manual.
 4. The request shall specifically state the reason that the product is unavailable with evidence to substantiate the reason.
 5. Requests made directly to Architect by suppliers, subcontractors and distributors that are not from the Contractor will not be accepted by the Architect or Owner.
 6. Architect will approve or reject substitution in writing.
 7. Substitutions will not be considered if they are indicated or implied on Shop Drawings.
- E. Contractor shall submit descriptive brochures, drawings, samples and other data as is necessary to provide direct comparison to the specified materials after reviewing and determining that product meets specified requirements. Submittals shall be well marked and identified as to types and kind of the items being submitted for approval. Lack of sufficient information will be cause for rejection. Reference to catalogs will not be acceptable unless catalog is submitted with approval request and the specific product or material and its components are clearly identified.
- F. In submitting a substitution, the Contractor makes the following representations:
1. Proposed substitution has been fully investigated and determined to be equal or superior to specified product or material.
 2. The same warranty will be furnished for proposed substitution as for specified product or material.
 3. The same maintenance service and source of replacement parts, as applicable, is available.
 4. Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
 5. Cost data included on the substitution request is complete. Claims for additional costs related to accepted substitution and its impact on other portions of the Work which may subsequently become apparent are waived.
 6. Proposed substitution does not affect dimensions and functional clearances.

7. Payment for costs for additional services of Architect caused by the substitution shall be paid by Contractor. The Contractor will be billed for additional services at the current hourly rate charged by the Architect. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor.
8. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 EXAMINATION AND COORDINATION OF WORK

- A. Verification of Conditions: Examine and verify surfaces, subsurfaces, condition and serviceability of previous work to receive subsequent work and report detrimental conditions in writing to the Architect.
- B. Commencement of work acknowledges acceptance and serviceability of previous work.
- C. Coordination: Coordinate with other work which affects, connects with, or will be concealed by subsequent work.
 - 1. Work within concealed ceiling and plenum spaces shall be coordinated with all other work within these spaces to assure a coordinated assembly.
 - 2. Coordinate location and layout of mechanical, electrical and other systems located within suspended ceilings.
 - 3. Utilize Revit Model to create fully coordinated model and Shop Drawings of Project infrastructure. Perform clash detection analysis and report conflicts to Architect.
 - 4. Notify Architect immediately if conflicts are found.
 - 5. Adjust work in place in concealed ceiling spaces as required to allow installation of other work which cannot be adjusted.
- D. Any remedial work required to be performed on previously placed work after new work has commenced shall be by and at the expense of the Contractor and/or sub-contractor having commenced the new work.

1.02 TOLERANCES

- A. Certain tolerances are listed in the various specification sections and on the Drawings. In addition, other tolerance limits are set forth below. These tolerances are the maximum variation allowed on the Project.
- B. Each of the Contractors shall review the tolerance limits established for their work as they relate to the other work on the Project. Should the tolerance limits established for their work be in conflict with those limits established for other adjoining work, the Architect and Owner shall be notified before proceeding.
- C. It is the intention of the Contract Documents that, assuming work in place is within the tolerance limits established, or has been accepted by following contractor(s), subsequent work shall be adjusted as required.
- D. Tolerances:
 - 1. Concrete: 1/8 inch plus or minus in any 10 feet and 3/4 inch total overall in any direction.
 - 2. Masonry: 1/8 inch plus or minus in any 10 feet and 1/4 inch total overall in any direction.
 - 3. Structural Steel: 1/8 inch plus or minus in 60 feet and 1/2 inch total overall in any direction.
 - 4. Miscellaneous Metal: 1/8 inch plus or minus in 20 feet and 1/4 inch total overall in any direction.

5. Ornamental Metal: 1/8 inch total overall in any direction.
 6. Drywall: 1/16 inch plus or minus in any 12 feet and 1/8 inch total overall in any direction.
 7. Acoustic Tile: 1/8 inch maximum variation overall in any direction.
 8. Granite and Marble: 1/16 inch maximum variation overall in any direction.
 9. Millwork: 1/16 inch Maximum overall in any direction.
 10. Ceramic Tile: 1/16 inch maximum overall in any direction.
- E. All materials such as Stone tile and veneers, acoustic tile, lay-in acoustical panel and decorative ceilings, ceramic tile, VCT, wood flooring, and so forth, are to meet flush with adjacent pieces of the same material.

1.03 APPROVED APPLICATORS

- A. Where specific instructions in the Specifications require that a particular product and/or material be applied and/or installed by an "approved applicator" it shall be the Contractor's responsibility to insure that any subcontractor or sub-subcontractor used for such Work is in fact currently certified by the particular Manufacturer for this type of installation or application.

1.04 APPROVED MANUFACTURERS

- A. Each Section includes a list of Manufacturers whose equipment is acceptable as to manufacture, subject to conformance with the Contract Documents. Careful checking must be completed by the Contractor and the manufacturer or equipment supplier to verify that the equipment will meet all capacities, requirements, space allocations and is suitable for the intended purpose specified.

1.05 REFERENCE DATA

- A. Reference data made available to the Contractor is for the Contractor's information only, and neither the Owner nor the Architect assume any responsibility for the Contractor's conclusions.
- B. The Contractor shall establish and maintain all building and construction grades, lines, levels, and bench marks. This Work shall be performed by a licensed Civil Engineer or Surveyor under the employ of the Contractor, who shall certify to the Owner that he has performed this service.
- C. The Contractor shall not remove any fixed property line markers, monuments or data.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cutting, fitting and patching, including attendant excavation and backfill required to complete Work, and for:
 - 1. Making several parts fit together properly.
 - 2. Uncovering portions of Work to provide for installation of ill-timed Work.
 - 3. Removing and replacing defective and non-conforming Work.
 - 4. Removing samples of installed Work required for testing, as directed by Architect.
 - 5. Providing routine penetrations of non-structural surfaces for installation of piping electrical conduit, and similar items.

1.02 SUBMITTALS

- A. In advance of executing any cutting or alterations, submit written request to Architect requesting consent to proceed with cutting which affects:
 - 1. Work of Owner or other trades.
 - 2. Structural value or integrity of any element of Project.
 - 3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 4. Efficiency, operational life, maintenance or safety of operational elements.
 - 5. Visual qualities of sight-exposed elements.
- B. Include in request:
 - 1. Identification of Project.
 - 2. Description of affected Work.
 - 3. Necessity for cutting, alteration or excavation.
 - 4. Effect of Work of Owner or other trades, or structural or weatherproof integrity of Project.
 - 5. Description of proposed Work:
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Trades which will execute Work.
 - c. Products proposed to be used.
 - d. Extent of refinishing to be done.
 - 6. Alternatives to cutting and patching.
 - 7. Cost proposal, when applicable.
 - 8. Written permission of trades whose Work will be affected.
- C. Submit written notice to Architect designating time work will be uncovered and when work will be performed to provide for observation when necessary.

1.03 PAYMENT FOR COSTS

- A. Payment caused by ill-timed or defective work or work not conforming to Contract Documents, including costs for additional services of Architect and Engineer shall be paid by Contractor. The Contractor will be billed for additional services at the current hourly rate charged by the Architect. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor.

- B. Payment of work done on written instructions of Architect, other than defective or nonconforming work, will be paid by Owner on approval of a written Change Order. Provide written cost proposal prior to proceeding with cutting and patching instructed by Architect for other than defective or nonconforming work. All work shall be approved by Architect and Owner prior to commencement.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide for replacement of Work removed. Comply with Contract Documents for type of Work standards and Specification requirements for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions of Work, including elements subject to movement or damage during cutting and patching, and excavating and backfilling. After uncovering Work, inspect conditions affecting installation of new products and verify procedures with Architect.
- B. Report unsatisfactory or questionable conditions in writing to Architect/Engineer. Do not proceed with Work until further instructions are received.

3.02 PREPARATION

- A. Provide shoring, bracing and supports as necessary to maintain structural integrity of work. Design of shoring, bracing and supports shall be performed by an Engineer registered in the State of Arizona.
- B. Provide devices and methods to protect other portions of Work from damage, including elements which may be exposed by cutting and patching Work. Maintain excavations free from water.

3.03 ERECTION, INSTALLATION AND APPLICATION

- A. Performance:
 - 1. Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
 - 2. Execute cutting and demolition by methods which prevent damage to other Work to provide proper surfaces to receive installation of repairs and new Work.
 - 3. Execute excavating and backfilling by methods which prevent damage to other Work and settlement as specified in Section 31 01 00.
- B. Employ original installer or fabricator to perform cutting and patching for:
 - 1. Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants and waterproofing.
 - 2. Sight-exposed finished surfaces.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes as shown on Drawings and as specified.

- D. Fit Work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces. Conform to fire code requirements for penetrations and maintain integrity of fire walls and ceilings.
- E. Restore Work which has been cut or removed. Install new products to provide completed Work in accordance with requirements of Contract Documents and as required to match surrounding areas and surfaces.
- F. Refinish entire surfaces as necessary to provide an even, matching finish as follows:
 - 1. Painted Walls or Ceilings: To nearest intersection with another finish or corner.
 - 2. Where applied finishes occur (i.e wallcovering, tile, wood paneling): To nearest intersection of finish without damage to adjacent material. Where match of pattern, grain, texture, or similar finish cannot be made, refinish area to intersection with other finish or internal corner.
 - 3. Manufactured or shop fabricated materials: Replace entire affected surface or entire component.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 FINAL CLEANING

- A. Perform the following special cleaning for trades at completion of Work. Employ experienced workmen or professional cleaners for the final cleaning:
 - 1. Remove marks, stains, fingerprints, soil and dirt from paint, stain and wall covering.
 - 2. Remove spots, soil, paint and mastic from tile work and wash same.
 - 3. Clean fixtures, equipment and piping; remove stains, paint, dirt and dust.
 - 4. Remove temporary floor protections; clean and polish floors.
 - 5. Clean concrete walks and slabs of plaster or cement droppings, paint and other objectionable materials to present a neat, clean appearance.
 - 6. Clean exterior and interior metal surfaces, including doors and windows and their frames.
 - 7. Remove oil, stains, dust, dirt, paint and the like from items required to have a polished finish; polish and leave without fingermarks or other blemishes.
 - 8. Wash interior and exterior glazing, inside and outside.
 - 9. Polish mirrors.
- B. Make building(s) ready for occupancy in every respect. Lay heavy building paper in main circulation areas to protect the floors until final inspection and acceptance.
- C. Existing improvements, inside or outside the property which are disturbed, damaged or destroyed by the Work under the Contract shall be restored to their original condition unless as part of the Work, improvements were required.

1.02 PROJECT RECORD DOCUMENTS

- A. As the work progresses, the Contractor shall maintain a complete and accurate record of changes or deviations from the Contract Documents and Submittals, indicating the Work as actually installed. Document information by daily corrections and/or additions in the appropriate locations on a PDF or other suitable electronic copy of the Construction Documents and Submittals and PDF or other suitable electronic copy of the Specifications which shall be maintained by the Contractor solely for the purpose of this documentation. Contractor shall maintain this electronic set of Construction Documents and Submittals at the Project site for review by the Owner and Architect.
- B. Information contained in the Record Documents shall include, but not be limited to:
 - 1. Modifications made by Addenda, Bulletins, Change Orders, Construction Change Directives and Architect's Supplemental Instructions.
 - 2. Location of site underground pipes, conduits, ducts, cables and similar work, dimensioned horizontally to permanent points of reference and located vertically by indicating depth of burial and invert elevations. Dimensions shall be accurate within 2 inches.
 - 3. Location of building plumbing piping, sprinkler piping, control valves, shut-off valves, heating and air conditioning equipment, mechanical piping, ductwork, major conduit runs, power, control and alarm wiring, etc., dimensioned horizontally to permanent points of reference. Dimensions shall be accurate within 2 inches. By notation, describe the vertical location of the item such as "below slab," "above ceiling," etc.

4. Modifications made to accommodate field conditions.
 5. Location and function of mechanical and electrical control devices and shut-off valves.
 6. Panel schedules showing final circuiting of electrical fixtures and equipment.
- B. The Architect will provide PDF or other suitable electronic copy of the complete original bidding documents, at Contractor's expense. Seals and signatures of Registrants shall be completely removed and/or permanently obscured. Contractor shall provide the following on the Drawings:
1. Changes in the Contract Documents, secured with prior approval of the Architect, recorded on the PDF copy utilizing PDF writing software mark-up features, by a competent drafter. Deletions shall be made by electronic cross-out or other indication clearly indicating information deleted. Record information in adequate size lettering and notations to be legible at half size reproduction.
- C. Upon Substantial Completion of the Work, deliver the complete electronic set of Record Documents including Shop Drawings and annotated Specifications to the Architect for approval.
- D. Permit Record Set, as approved by all governing agencies shall be kept in secure location by the Contractor.

1.03 OWNERS MANUAL

- A. Owner's Manual: Prior to final payment, provide 1 digital copy and Three (3) hard-back, loose-leaf binders, suitably typed, indexed and labeled, containing the following:
1. Subcontractors and major suppliers list with companies names, addresses, email addresses and telephone numbers.
 2. Warranties and certifications.
 3. Affidavit from general and subcontractors on use of asbestos free materials.
 4. Maintenance/operation instructions.
 5. Parts list.
 6. List of Extra Materials delivered to Owner; signed for by Owner's representative.
 7. Other items required by the Specifications.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submittals: Submit two (2) draft copies of Operation and Maintenance Manuals for systems and equipment, including electrical and control items, and parts lists, a minimum of 14 days prior to requesting inspection for Substantial Completion, or scheduled Substantial Completion Date, whichever is earlier. Furnish separate copies for each Division.
1. Architect will review Manuals for general scope and content and return one copy of draft manuals with required action.
- B. Operating instructions shall include complete operating sequence, control diagrams, description of method of operating machinery, machine serial numbers, factory order numbers, parts, tests, instruction books, suppliers phone numbers, addresses, email addresses, and individual equipment guarantees. Parts lists shall be complete in every respect, showing parts and part numbers for ready reference.

- C. Maintenance instructions shall include a written list of required and suggested maintenance for mechanical, plumbing, electrical or other equipment or features in the project. Each item shall contain a brief description of the maintenance required as well as the recommended time frame or period for the maintenance. Include lists of filter sizes for air handling equipment, indicated "washable" or "disposable" and for which unit the filter is for.
- D. Provide operating and maintenance instructions on DVD, memory key or similar electronic media, either prepared by the Contractor or where available, manufacturers prepared operations and maintenance videos and/or instructions for each specific equipment item or system.
- E. Assemble maintenance manual and operating instructions in hard back loose leaf binders. Suitably label and index material for ready reference.
- F. Upon substantial completion of the Project Work, submit one copy of the Operation and Maintenance Manual and Parts Lists to the Architect for approval. Upon receipt of Notice of Approval, deliver the additional copy to the Owner. Include CD and/or DVD disks of materials in electronic format.

1.05 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Deliver spare parts, tools, extra stocks of material and similar physical items required by individual specification sections to the Owner with a copy of the transmittal to the Architect. Obtain signed receipts from the Owner for all items.
- B. Change over construction locks to permanent keying system. Deliver required number of keys to the Owner with a copy of the transmittal to the Architect. Obtain receipts from the Owner for delivered items.

1.06 ELECTRONIC COPIES OF IMAGE DOCUMENTS

- A. Upon completion provide CD, DVD, or memory key containing image copies in JPEG, PDF or other appropriate electronic format of all record and maintenance documents.

1.07 WARRANTIES

- A. Submit warranties required by individual specification Sections in duplicate, assembled in durable binders with a Table of Contents and a digital copy of same on DVD, memory key or other current electronic media.
- B. The date of commencement of warranties shall be the date of Substantial Completion except as may be modified by AIA Document G-704, Certificate of Substantial Completion, or by other written agreement with the Owner.

END OF SECTION

SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Selective demolition of minor above grade site improvements necessary or required so that the new construction and related work can be performed and completed in accordance with the Contract Documents.

1.02 SUBMITTALS

- A. Submit copies of permits and notices authorizing demolition as may be required by law, including permits to transport and dispose of debris.
- B. Submit project record documents which accurately record actual locations of capped utilities, and concealed obstructions in accordance with Section 01 77 00.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Conform to applicable code(s) for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.
 - 2. Obtain required permits from authorities necessary for demolition and transport and disposal of debris.
 - 3. Conform to applicable regulatory procedures if hazardous or contaminated materials are discovered.
- B. Provide storm water pollution control and provide a Storm Water Pollution Prevention Plan (SWPPP) as required by the City of Buckeye and the State of Arizona.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Unless specifically scheduled for reuse, demolished materials shall become the possession of the Contractor and shall be immediately removed from the site
- B. Fill materials at excavations: As specified in Section 31 00 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and notify the Architect in writing of discrepancies before proceeding with the work.

- B. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

3.02 PREPARATION

- A. Identify, disconnect, remove and cap designated utilities within site areas as indicated or required to accommodate new construction. Notify affected utility companies before starting work and comply with their requirements.
 - 1. Notify Blue Stakes and private utility locator companies for all utility locations not covered by Blue Stakes.
 - 2. Mark location of utilities.
- B. Provide, erect, and maintain temporary barriers and security devices where required and as indicated on drawings.
- C. Protect existing site improvements, landscaping materials, utilities, appurtenances, and other work indicated to remain. Where existing materials indicated to remain are disturbed or damaged by selective demolition operations, remove damaged materials and replace with new materials to match existing at no additional expense to the Owner.
- D. Protect bench marks and existing work from damage or displacement.
- E. Prevent movement or settlement of adjacent structures.

3.03 SELECTIVE SITE DEMOLITION

- A. Carry out demolition work to cause as little inconvenience to existing site areas as possible and with minimum interference to public or private accesses. Maintain protected egress and access at all times.
- B. Perform the removal, cutting, drilling, etc., of existing work with extreme care, and using small tools in order not to jeopardize the structural integrity of the building.
- C. Perform cutting of existing concrete and masonry with saws and core drills. Do not use jack-hammers.
- D. Provide hoses and water connections for sprinkling of debris as necessary to limit dust to lowest practicable level.
- E. Backfill areas excavated and open pits and holes caused as a result of demolition in accordance with Section 31 00 00. Rough grade and compact areas affected by demolition to maintain site grades and contours unless noted otherwise on drawings.
 - 1. Trenches and open pits within traffic areas which are left open for demolition or construction purposes shall be covered with properly supported heavy steel traffic bearing plates.
- F. Rebuild existing work/site improvements which must be removed to allow the installation of new work as indicated on the Drawings or where damaged by demolition operations.
- G. Material Disposal:
 - 1. Remove materials from site and dispose of in a legal manner at no additional expense to Owner.
 - 2. No materials are to be sold on, or adjacent to, the site. Signs advertising the sale of materials shall not be allowed.
 - 3. Burning of materials on site is not permitted.

4. Break concrete and masonry into sections less than 3 feet in any dimension.
5. Remove from site, contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers and public.
6. Debris from the demolition shall not be allowed to accumulate within the building or on the site.

END OF SECTION

SECTION 03 05 05

FLY ASH

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Fly ash admixture for incorporation into concrete mixes specified in the following specification sections:
1. Section 03 30 00 - Cast-In Place Concrete.
 2. Section 04 05 15 - Mortar and Masonry Grout.
 3. Section 32 13 13 – Concrete Paving.
 4. Section 32 16 00 - Concrete Curbs, Gutters, Sidewalks, and Driveways.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coal Fly Ash and Raw or Calcined Natural Pozzolan
1. Sampled and tested in accordance with the current edition of ASTM C 311, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
 2. Conform to the requirements of the current edition of ASTM C 618, Standard Specification of Coal Fly Ash and Raw and Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete, as follows:
 - a. Meet the requirements of ASTM C 618, Table 1 Chemical Requirements and Table 1A Supplementary Optional Chemical Requirements.
 - b. Meet the requirements of ASTM C 618, Table 2 Physical Requirements and Table 2A Supplementary Optional Physical Requirements in the following areas:
 - 1) Effectiveness in Controlling Alkali-Silica Reaction.
 - 2) Effectiveness in Contributing to Sulfate Resistance, Procedure A.
 - 3) Uniformity Requirements when air-entraining concrete is specified:
 3. Source Quality Control:
 - a. Fly ash shall come from sources with an established quality control program to demonstrate that the fly ash consistently conforms to ASTM C 618 specification and uniformity requirements. The quality history shall include a minimum of 40 test results representing a minimum of the previous 6 months production of fly ash.
 - b. Per the current edition of ACI 232, Use of Fly Ash in Concrete, section 5.6, the fly ash quality history shall be available that demonstrates at least monthly ASTM C 618 certification results from a Cement and Concrete Reference Laboratory (CCRL) accredited laboratory. A minimum of 20 reports representing at least 6 months of fly ash production is required.

2.02 MIXES

- A. Provide fly ash admixture for incorporation into concrete mixes as specified in the following specification sections:
1. Section 03 30 00 - Cast-In Place Concrete.
 2. Section 04 05 15 - Mortar and Masonry Grout.
 3. Section 32 31 13 – Concrete Paving.
 4. Section 32 16 00 - Concrete Curbs, Gutters, Sidewalks, and Driveways.
- B. Proportioning:
1. Per ACI 232, Use of Fly Ash in Concrete, section 4.1, the most effective method for proper proportioning of concrete for a specific application is by use of a trial batch and testing program per ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete. When necessary, a series of mixtures shall be prepared and tested to determine the proper proportions for the specific project requirements.
 2. Fly ash, when used, shall not replace more than 18 percent of cement content by weight.
 3. Fly ash shall not be used in architectural exposed concrete or concrete slabs with a burnished or acid finish.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Formwork for cast-in-place concrete, including, but not limited to:
 - 1. Installation of embedded items.
 - 2. Shoring, Bracing and Anchorage, including openings for other Work
 - 3. Form Accessories
 - 4. Form Stripping.

- B. Related Sections:
 - 1. Section 03 11 19 – Insulating Concrete Forms (ICFs), for stay-in-place insulating concrete forms for structural cast-in-place concrete walls.

1.02 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.03 SUBMITTALS

- A. Shop Drawings: Show form construction including jointing and other items that affect exposed concrete visually. The Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is the Contractor's responsibility.

- B. Product Data: Provide data on accessory materials and installation requirements.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347R - Guide to Formwork for Concrete.

1.05 QUALIFICATIONS

- A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Arizona.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site to prevent deterioration and damage.

- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.07 COORDINATION

- A. Coordinate this Section with other Sections of Work which require attachment of components to formwork.

- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect's Structural Engineer before proceeding.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Concealed Concrete: Plywood, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit. For use in below grade concrete or concrete covered by another finish. Not for use where finished concrete is exposed to view.
 - 1. Plywood, Douglas Fir species; APA grade-trademarked; BB Plyform, Class 1, Exterior Grade as per PS1.
 - 2. Lumber: Spruce, Pine or Fir species; construction grade, with grade stamp clearly visible.
 - 3. Plywood shall have mill applied release agent and edge seal.
- B. Forms for Exposed Concrete: Plywood, MDO, tempered concrete-form-grade hardboard, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surface. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system where shown on Drawings. For use in exposed to view concrete that is not covered by another finish.
 - 1. MDO (medium density overlay), class 1 or better, with mill applied release agent and edge seal.
 - 2. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C of B-B High Density Overlaid Concrete Form," Class I.
 - 3. Tempered concrete-form-grade hardboard, with applied release agent and edge seal.
 - 4. MDO, plywood, and hardboard forms shall have mill applied release agent and edge seal.
- C. Forms for Cylindrical Columns and Supports. Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- D. PVC Sleeves: ASTM D1758, PVC 1120 compound, Schedule 40.

2.02 FORMWORK ACCESSORIES

- A. Form Ties: Removable or snap-off type, free of defects that could leave holes larger than one inch in concrete surface.
- B. Form Release Agent: 100 percent biodegradable, zero VOC, vegetable base, colorless, which will not stain concrete, or impair natural bonding or color characteristics of coating intended for use on concrete.
 - 1. Do not use petroleum-based agents. Paraffin and waxes shall not be used when a concrete finish is required.
- C. Corners: Chamfered wood strip type or vinyl bead; 3/4 inch x 3/4 inch size; maximum possible lengths.
- D. Flashing Reglets: Galvanized steel 22 gauge thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.02 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Arrange formwork for exposed concrete in an orderly and symmetrical manner to produce smooth concrete finish indicated.
- C. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.
- E. Align joints and make watertight. Keep form joints to a minimum.
- F. Obtain approval from Architect before framing openings in structural members which are not indicated on Drawings.
- G. Provide chamfer strips on external vertical wall corners where exposed in the finished Work. Chamfer strip is not required on exposed foundation corners where exposed less than 12 inches.
- H. PVC Sleeves: Set PVC sleeves in proper alignment and position. End of sleeves shall be flush with finished concrete surface.

3.03 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with Manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in or passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.

- C. Coordinate Work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.
- D. Install accessories in accordance with Manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.05 FORM CLEANING

- A. Clean and remove foreign matter within forms as erection proceeds.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.06 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Construct formwork as required to produce concrete members of size, shape, configuration, alignment, elevation and position indicated on Drawings within tolerance limits of ACI 301.
- C. Surface Irregularities: Construct and maintain formwork to produce concrete having the following formed finish Class and permitted abrupt or gradual irregularities as designated by ACI 347-04.
 - 1. Vertical and horizontal exterior exposed surfaces: Class B, 1/4 inch.
 - 2. Other surfaces prominently exposed to public view: Class B, 1/4 inch.

3.07 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that Work is in accordance with formwork design, and that support, fastenings, wedges, ties and items are secure.
- B. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.08 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads. Forms shall be removed in accordance with the requirements of the General Structural Notes.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

- D. Formwork for stem walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage.
- E. Cure exposed concrete in accordance with Section 03 30 00 whenever the formwork is removed during the curing period.

3.09 REMOVAL STRENGTH

- A. When formwork removal is based on the concrete reaching its specified 28 day strength (or a specified percentage thereof), the concrete shall be presumed to have strength when either of the following conditions has been met:
 - 1. When test cylinders, field cured under the most unfavorable conditions prevailing for any portion of the concrete represented, have reached the required strength.
 - 2. When the concrete has been cured for the same length of time as the age, at test, of laboratory cured cylinders which reach the required strength. The length of time concrete has been cured in the field shall be determined by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50 degrees F. and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

END OF SECTION

SECTION 03 11 19

INSULATING CONCRETE FORMS (ICF's)

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Stay-in-place insulating concrete forms for structural cast-in-place concrete walls. Includes the installation of concrete steel reinforcement and the placement of concrete within the insulating concrete forms.
- B. Cast-in-place concrete walls include the construction of the following:
 - 1. Exterior load bearing, and non-load bearing walls as indicated on Structural Drawings.
- C. Bracing and scaffolding shall be provided to comply with all applicable codes.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.
- B. Code Compliance Data: Submit relevant code compliance data.
- C. Drawings and Calculations: Submit project drawings, details of construction, and structural calculations as required by the local building department.
- D. Steel Reinforcement and Concrete: Submit the reinforcement schedule and concrete mix design as proposed for use.

1.03 QUALITY ASSURANCE

- A. Comply with applicable governing codes and regulations.
- B. Follow manufacturer's training and installation procedures.
- C. Installer Qualifications: Installation of insulating concrete formwork shall be performed by a company specializing in performing Work of this Section with a minimum of 5 years documents experience and whose installers are trained and certified by the insulating concrete form manufacturer to perform work.
- D. Contractor is responsible for proper construction and placement of forms, steel reinforcement and concrete.
- E. Material in contact with the insulating concrete form must be compatible with expanded polystyrene.
- F. Standards: Comply with the following as applicable.
 - 1. ACI 301 Standard Specifications for Structural Concrete
 - 2. ACI 318 Building Code Requirements for Structural Concrete
 - 3. ACI 332 Guide to Residential Cast-in-Place Concrete Construction
 - 4. ASTM C 94 28-Day Concrete Compressive Strength
 - 5. ASTM C 150 Portland Cement
 - 6. ASTM C 33 Normal Weight Aggregates
 - 7. ASTM C 330 Light Weight Aggregates

8. ASTM C618 Fly Ash
9. ASTM A615 Steel Specifications for Steel Reinforcement
10. ASTM A185 Steel Wire Fabric Specifications
11. ASTM E84 Surface Burning Characteristics of Building Materials

1.04 SYSTEM DESCRIPTION

- A. Insulating concrete form consists of panels of expanded polystyrene nominal density 1.5 lbs/ft³ connected by manufacturer's standard ties.
- B. Provides overall wall section thickness and concrete cross section as indicated on the Drawings.
- C. Provide plastic ties recessed 1/2" behind each face of expanded polystyrene and located 6" o.c. to provide 1-1/4" wide furring strip the full height of wall to fasten exterior and interior finishes.
- D. Interior ICF wall finish shall provide a plumb and straight surface ready to receive direct applied gypsum board without the need for additional framing or furring where indicated on Drawings.
- E. The wall system shall provide a calculated R-22 insulation value.
- F. The wall system provides fire resistance ratings and superior sound attenuation values.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver the product in original factory packaging with product listing label and manufacturing label.
- B. Handle and store the product to prevent damage and deterioration.
- C. Protect from prolonged exposure to the sunlight's UV rays.

1.06 PROJECT CONDITIONS

- A. Follow manufacturers requirements for protection and placement of concrete during construction periods when the weather is below the minimum specified by the building codes to ensure proper curing conditions.

1.07 WARRANTY

- A. Furnish manufacturer's standard product warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Furnish products of one of the following Manufacturers, except as otherwise approved by the Architect, subject to compliance with Specification requirements:
 1. Fox Blocks; Division of Airlite Plastics www.foxblocks.com
 2. Nudura integrated Building Technology www.nudura.com
 3. Equal as prior approved by Architect and Owner.

- B. Basis of Design: Drawings and detailing are based on ICF as manufactured by Nudura. Where other ICF materials are used in the actual Work, the Contractor is responsible for all design and detailing changes that may be affected by differences in the forms or installation of the forms that necessitate changes/modifications in the design and detailing.

2.02 MATERIALS

- A. Provide insulating concrete forms conforming to ACI 332 and as indicated on the Drawings and as required for complete installation as shown.
 - 1. Flame Spread Index: Not to exceed 25 when tested in accordance with ASTM E84.
 - 2. ICF Sizes: 11-1/4 inches thick, unless otherwise indicated on Drawings.
- B. Concrete
 - 1. Concrete supplied under Section 03 30 00 shall meet the compressive strength requirement as specified in the General Structural Notes.
 - 2. Recommended concrete mix shall include a concrete slump and aggregate size as indicated on the Structural Drawings and as recommended by the form system manufacturer.
- C. Steel Reinforcement
 - 1. Steel reinforcement shall be supplied and placed in the formwork as specified by the design engineer or prescriptive reinforcement tables.
- D. Auxiliary Materials
 - 1. Sufficient bracing, wall alignment and scaffolding
 - 2. Waterproofing materials for below grade applications
 - 3. Exterior finishes
 - 4. Interior finish must meet code requirement for 15 minute thermal barrier
 - 5. Door and window opening bucks
 - 6. Penetration and sleeve material
 - 7. Anchors and anchor bolts

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all items in the Work Included section and verify site conditions.
- B. Verify footings are installed within +/- 1/4" of level and step footings are 16" in height.
- C. Verify steel reinforcement vertical dowels are in place as specified by design.

3.02 PREPARATION

- A. Clean top of footings and organize materials and equipment before starting formwork.

3.03 INSTALLATION

- A. Installation of forms and contractors work must be in accordance to manufacturer's installation manual and training procedures including:
 - 1. Placement of forms.
 - 2. Steel reinforcement placement.
 - 3. Concrete placement.

4. Door and window opening construction.
 5. Bracing, scaffolding and wall alignment.
 6. Anchors, anchor bolts, penetrations.
 7. Final pre-pour checklist.
- B. Place and lap reinforcement in accordance with Structural Drawings.
- C. Mechanically vibrate all concrete when faced.
- D. Place concrete in maximum lifts indicated in General Structural Notes on Structural Drawings.
- E. Interior ICF Wall Finish: Remove fins, stone projecting joint marks and out-of-plane surfaces to produce a straight, plumb wall surface without projections or surface irregularities. Interior ICF wall finish shall provide a plumb, smooth and straight surface ready to receive direct applied gypsum board without the need for additional framing or furring where indicated on Drawings.
1. Tolerances: 1/8 inch maximum from plumb and smooth surface in 8'-0".
- F. Exterior ICF Wall Finish: Remove fins, stone projecting joint marks and out-of-plane surfaces to produce a straight, plumb wall surface without projections or surface irregularities ready to receive direct applied plywood wall sheathing where indicated on Drawings.
1. Tolerances: 1/8 inch maximum from plumb and smooth surface in 8'-0".
- 3.04 FIELD QUALITY CONTROL
- A. Ensure that the cast-in-place concrete walls are level, plumb, square and straight and that all dimensions conform to the drawings.
- 3.05 CLEANUP
- A. Clean up and dispose of all debris on job site related to the installation of the insulating concrete forms.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Concrete reinforcement as shown on the Drawings and as specified.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete, for Fiber Reinforcement.

1.02 QUALITY ASSURANCE

- A. Comply with ACI-301, Chapter 5, except where more exacting requirements are specified.
- B. Comply with requirements in AWS-D12.1, except where more exacting requirements are specified in the Contract Documents.

1.03 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing bending and placing of reinforcing. Include diagrammatic elevations of walls at a scale sufficiently large to show clearly the position and erection marks of marginal bars and their dowels and splices and bar arrangement for more than one layer of reinforcing steel in concrete sections.
- B. Certificates: Submit certified mill test reports for review prior to fabrication.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Shipping: Deliver reinforcement to the Project site bundled, tagged and marked to facilitate sorting and placing. Tags shall indicate bar sizes, lengths, grade and other information corresponding to markings shown on placement diagrams.
- B. Storage and Protection: Store reinforcement at the site off the ground and in a manner to prevent damage to the materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: New billet-steel, deformed bars conforming to ASTM A615, Grade 60, with a minimum yield of 60 ksi for all bars #4 and larger and ASTM A615, Grade 40 with a minimum yield of 40 ksi for all bars #3 and smaller, unless otherwise indicated on Drawings. Grade 60 bars indicated to be welded shall be ASTM A706.
- B. Welded Wire Fabric: ASTM A185 using bright steel wire meeting the requirements of ASTM A82. Gauges and dimensions as noted on the Drawings. Provide in flat sheets only.
- C. Chairs: Galvanized steel or plastic tipped.
- D. Tie Wire: ASTM A82, 16 gauge or heavier, black annealed.

- E. Welding Rods: E-70 Series for A615 Grade 40 (ASTM A615M, Grade 300) reinforcing, and E-90 Series for A706 reinforcing; low hydrogen conforming to AWS A-5.1.

2.02 FABRICATION

- A. Shop fabricate bars as far as is practical. Bend bars cold. Make bends for stirrups and ties around pins having diameters at least 2 times the thickness of the bars; for other bars 1 inch diameter and smaller, 6 times the thickness; for larger bars 8 times the thickness.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Determine weldability of reinforcing steel by laboratory chemical analysis of steel. Only steel conforming to chemical requirements specified in AWS D12.1 may be welded.

3.02 PLACING REINFORCEMENT

- A. General:
 - 1. Place in accordance with ACI 318 and as shown.
 - 2. Accurately place reinforcement and securely tie at intersections with 16 gauge black annealed wire.
 - 3. Maintain reinforcing in proper position by chairs, bar supports or other approved devices.
 - 4. Bars in footings shall be supported on precast concrete blocks.
 - 5. The bending or field cutting of bars around openings or sleeves will not be permitted.
 - 6. Reinforcing steel in beams and slabs shall not be placed until after concrete in walls and columns has been poured.
- B. Splices in concrete beams, columns, walls, slabs, and footings shall be per typical detail on Structural Drawings. Splices shall be Class B tension splices (2'-0" minimum), unless otherwise indicated on Drawings. Stagger a minimum of one lap length. Hook horizontal bars around corners not less than 24 diameters, with a minimum of 12 inches as per typical details.
- C. Concrete protection of reinforcing shall be not less than the following:
 - 1. Concrete is poured against and permanently exposed to ground: 3 inches.
 - 2. Concrete is poured against forms but may be in contact with ground:
 - a. #5 and under: 1-1/2 inches.
 - b. #6 and larger: 2 inches.
 - 3. Exterior face of exterior walls (exposed to weather but not in contact with ground): 1-1/2 inches minimum.
 - 4. Interior walls and interior face of exterior walls: 3/4 inch minimum.
 - 5. Beams, girders and columns: 1-1/2 inches.
 - 6. Interior Slabs: 1 inch.
- D. Clear distance between bars shall be not less than 1-1/2 times the maximum size of coarse aggregate unless noted otherwise.

- E. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter or enough to exceed code tolerances, resulting arrangement of bars shall be subject to review of Architect.
- F. Bars with kinks or bends not indicated shall not be used. Reinforcement shall not be bent or be straightened in a manner that will weaken the material, or be bent after being partially embedded in hardened concrete.
- G. Wire mesh in slabs: Laps in welded wire fabric shall be made so that the overlap, measured between outermost cross wires of each fabric sheet, is not less than the spacing of cross wires plus 2 inches.

3.03 CLEANING

- A. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of off premises. Leave Work in clean condition.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Cast-in-place concrete including, but not limited to, the following:
 - 1. Building footings, foundations, slabs on grade.
 - 2. Site structures including, but not limited to, footings and foundations for site structures, site walls, gates and gate operators, site lighting supports, electrical and mechanical equipment support pads, and other site furnishing and equipment requiring cast-in-place concrete items.
 - 3. Concrete fill for pipe bollards specified in Section 05 50 00.
 - 4. Other items as indicated on Drawings.

- B. Related Sections:
 - 1. Section 03 05 05 – Fly Ash
 - 2. Section 03 10 00 – Concrete Formwork
 - 3. Section 03 11 19 – Insulating Concrete Forms (ICFs)
 - 4. Section 03 20 00 – Concrete Reinforcement
 - 5. Section 03 35 33 – Decorative Concrete Finishes, for ground and polished concrete finish.
 - 6. Section 32 13 13 – Concrete Paving.
 - 7. Section 32 16 00 – Concrete Curbs, Gutters, Sidewalks and Driveways

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Interior slabs on grade scheduled to receive applied floor finishes (VCT, resilient flooring, etc.) shall be tested as specified herein under Field Quality Control Calcium chloride test requirements. Moisture vapor from the floor must be less than 3 pounds per 1,000 square feet per 24 hours.

1.03 SUBMITTALS

- A. Mix Design: Submit mix design for each class of concrete to the Architect for review. Review of mix designs by Architect and/or Engineer shall in no way relieve the Contractor of responsibility for the performance of the concrete.

- B. Product Data: Submit Manufacturer's Specifications and performance data for accessory products.

- C. Shop Drawings: Submit shop drawing showing proposed location of construction joints, expansion/contraction joints and control joints and obtain approval of same from Architect prior to construction.

- D. Samples of materials, including names, sources and descriptions, of the following:
 - 1. Vapor Barrier.

1.04 QUALITY ASSURANCE

- A. Standards:
 - 1. Standard for measuring, mixing, transporting and placing of concrete shall be ACI-301 and ACI-304.

2. Standard for measuring, mixing and delivery of ready mixed shall be ASTM C94, except that time in mixer after water has been added at batch plant is limited to 1-1/2 hours.
 3. Job-mixed concrete shall be subject to Architect's review of design, mixing and handling procedures.
- B. Pre-Installation Conference:
1. Contractor shall conduct a meeting at Project site to review proposed mix designs and discuss required methods and procedures to achieve required concrete construction.
 2. Contractor shall distribute meeting agenda to all attendees a minimum of 7 days prior to the scheduled date meeting.
 3. Attendees: Responsible 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. Laboratory responsible for concrete design mix.
 - c. Laboratory responsible for field quality control.
 - d. Concrete subcontractor.
 - e. Ready-mix concrete producer.
 - f. Admixture manufacturer(s).
 - g. Concrete placement equipment manufacturer(s).
 4. Meeting minutes will be taken by the Contractor for distribution to all attendees within 5 days of meeting. Contractor shall also distribute copy of meeting minutes to Owner, Structural Engineer, and Architect.
 5. Minutes shall include statement by concrete subcontractor indicating proposed mix design, placement, finishing and curing procedures can produce the concrete quality required by these specifications.
- C. Static Coefficient of Friction: Sealed concrete floors shall have a tested coefficient of friction of 0.71 minimum dry, 0.6 minimum wet for level surfaces and treads of stairs and 0.8 minimum wet or dry for ramp surfaces when tested in accordance with ASTM D2047 / UL410.

1.05 PROJECT CONDITIONS

- A. Rain protection: Do not place concrete during rain unless adequate protection has been provided.
- B. Cold weather protection: Comply with ACI-306R.
- C. Hot weather protection: Comply with ACI-305R and 305.1-06.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type II, alkali content not to exceed 0.6 percent. Use one brand and type of cement throughout Project unless otherwise specified.
- B. Aggregate - Structural Concrete: Clean, coarse aggregate and gravel, free from foreign matter, conforming to ASTM C33. Aggregate shall be graded from coarse to fine in accordance with ASTM C33, Size 67.

- C. Admixtures:
1. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures. Provide one of the following:
 - a. AEA-92 and Air 40, Euclid Chemical Co. www.euclidchemical.com
 - b. Sika AER, Sika Corp. www.sikaconstruction.com
 - c. Master Builders MB-VR or MB-AE, BASF Admixtures www.basf-admixtures.com
 2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.05 percent chloride ions. Provide one of the following:
 - a. Eucon NW or Eucon WR 91, Euclid Chemical Co.
 - b. Master Builders Pozzoloth 322N, BASF Admixtures
 - c. Plastocrete 160, Sika Chemical Corp.
 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G and containing not more than 0.05 percent chloride ions. Provide one of the following:
 - a. Eucon 37/Eucon 1037, or Plastol Series, Euclid Chemical Co.
 - b. Daracem 100 or ADVA Flow, W.R. Grace & Co.
 - c. Master Builders Rheobuild 1000 or Glenium 3030, BASF Admixtures.
 4. High-Range, Water-Reducing, and Retarding (Superplasticizer): ASTM C 494, Type G. Provide one of the following:
 - a. Eucon 537, Euclid Chemical Company
 - b. Daracem 100, W.R. Grace & Co.
 - c. Master Builders Rheobuild 916, BASF Admixtures
 5. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Provide one of the following:
 - a. Accelguard 80, 90 or NCA, Euclid Chemical Co.
 6. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and contain not more than 0.05 percent chloride ions. Provide one of the following:
 - a. Eucon NR or Eucon Retarder 100, Euclid Chemical Co.
 - b. Master Builders Pozzoloth Retarder, BASF Admixtures.
 - c. Plastiment, Sika Chemical Co.
 7. Fly ash admixture: In accordance with Section 03 05 05 and General Structural Notes on Structural Drawings.
 8. Use set-retarding admixtures during hot weather only when approved by Architect.
 9. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- D. Fiber Reinforcement: Synthetic macrofibers conforming to ASTM C1116, Type 3, 1.502.0 inches in length and aspect ratio of 50 to 90.
1. Acceptable Products: Euclid Chemical, Tuf-Strand SF, or equal as approved by Structural Engineer.

E. Water: Potable.

2.02 ACCESSORIES

- A. Bonding Agents and Repair Products:
1. Interior Only (PVA): L&M Construction Chemicals EVERWELD www.lmcc.com; EucoWeld, Euclid Chemical Company www.euclidchemical.com; US Spec Bondcoat PVA www.usspec.com; or Larsens' Weld Crete www.larsenproducts.com

2. Interior Only for Bonding Existing Concrete to Fresh Concrete (Epoxy): Sikadur 32, Hi-Mod, Sika www.sikausa.com; Euco 452 Series, Euclid Chemical Company www.euclidchemical.com; Maxi-Bond 2500, US Spec www.usspec.com; or Rezi-Weld, W.R. Meadows www.wrmeadows.com.
 3. Exterior and Interior Bonding Admixture (acrylic latex): SBR Latex or Flexcon Euclid Chemical Company www.euclidchemical.com; Intralok, W.R. Meadows www.wrmeadows.com; Acylcoat, US Spec www.usspec.com; or Dayton Bond J40, Dayton Superior www.daytonsuperior.com.
 4. Polymer Repair Compounds: Polymer and microsilica modified cementitious based compounds.
 - a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - b. Horizontal Locations:
 - 1) Sikatop 121 or 122, Sika Chemical www.sikausa.com
 - 2) Thin Top Supreme, Concrete Top Supreme, Euclid Chemical Company www.euclidchemical.com
 - 3) TP Mortar, US Spec www.usspec.com
 6. Underlayment Topping: Free-flowing, self-leveling, pumpable cementitious base compound.
 - a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - 1) Ardex K-15, Ardex Inc.
 - 2) Flo-Top or Super Flo-Top, Euclid Chemical Company
 - 3) Self-Leveling Underlayment, US Spec
 - 4) Underlayment 110, BASF
 7. Repair Topping: Latex modified, sandless cementitious mortar topping with bond strength meeting or exceeding requirements of ASTM C1059.
 - a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - 1) Thin Top Supreme, Euclid Chemical Company
 - 2) TP Mortar, US Spec
 - 3) As approved by Architect.
- B. Non-Shrink Grout:
1. Premixed or prepackaged, non-metallic, non-gaseous, bleed free compound; non-shrink when tested in accordance with ASTM C 1107, Grade B at a fluid (flow cone) consistency of 20 to 30 seconds.
 2. Attain minimum compressive strength of 7,000 psi in 28 days at above fluid consistency.
 3. Fluid grouts: Remain workable, flow through flow cone after 20 minutes with slight agitation, in temperatures from 40 to 70 degrees F.
 - a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - 1) Suregrip High Performance, Dayton Superior, www.daytonsuperior.com
 - 2) Sikagrout 212, Sika www.sikausa.com
 - 3) Master Builders (Masterflow 713) www.masterbuilders.com
 - 4) W.R. Meadows No. 588 Grout www.wrmeadows.com
 - 5) L&M Construction Chemicals (DURAGROUT) www.lmcc.com
 - 6) US Spec "GP Grout" www.usspec.com
 - 7) Euclid N-S Grout www.euclidchemical.com.

4. High Flow Fluid Grouts: High flow grout shall achieve 95 percent contact when placed under an 18 inch x 36 inch base plate, remain workable, and flow through cone after 60 minutes in temperature from 70 to 90 degrees F.
 - a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - 1) Hi-Flo Grout, Euclid Chemical Company www.euclidchemical.com
 - 2) US Spec "MP Grout" www.usspec.com
 - 3) Chemrex Masterflow 928, BASF www.chemrex.com
- C. Epoxy Anchoring Adhesive: 2-component, high modulus, 100 percent solids epoxy gel adhesive complying with ASTM C881.
 1. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - a. Hilti HIT-RE 500-SD www.hilti.com
 - b. Simpson Strong-Tie Co. Set-XP www.simpsonanchors.com .
- D. Formed Construction Joint: Standard design plastikey, tongue and groove key joint; 3-1/2 inch vertical dimension for 4 inch slabs. For use only in slabs not exposed to vehicular traffic.
- E. Preformed Expansion Joint Filler: ASTM D1751.
- F. Liquid Curing and Sealing Compound:
 1. Verify that specified curing compound is compatible with the floor finish material(s) and adhesive(s) that will be applied to floor surface prior to delivery of curing compound to jobsite. If it is determined that the curing compound is not compatible with the floor finish material(s) and adhesive(s) that will be applied to floor surface, Contractor shall immediately notify Architect.
 2. Dissipating Hydrocarbon Resin Curing Compound: ASTM C309, VOC compliant, 350 g/l, for use on slabs receiving subsequent applied finishes and where noted on Drawings. Subject to compliance with requirements, provide one of the following:
 - a. Kurez DR VOX or Kurez W VOX, Euclid Chemical Company www.euclidchemical.com
 - b. Maxcure Resin Clear HS, US Spec www.usspec.com
 3. Clear Curing and Sealing Compound (Voc Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m² when applied at 300 sq. ft./gal. Manufacturer's certification is required. Subject to project requirements provide one of the following products:
 - a. Chemrex Kure 1315, BASF Construction Chemicals www.chemrex.com.
 - b. Lumiseal WB, L&M Construction Chemicals www.lmcc.com
 - c. Radiance UV-25, US Spec www.usspec.com
 - d. Super Diamond Clear VOX, Euclid Chemical Company www.euclidchemical.com
 - e. VOCCOMP-30, W.R. Meadows www.wrmeadows.com

- G. Sealer: VOC compliant, acrylic copolymer type.
1. Interior: ASTM C1315, Class A. Subject to requirements, Provide one of the following:
 - a. VOCOMP-30, W. R. Meadows.
 - b. Euclid Super Aqua Cure VOX, Euclid Chemical Company.
 - c. Dress & Seal WB #30, L&M Construction Chemicals.
 - d. J-19, Dayton Superior.
 2. Liquid Densifier-Sealer for Ground and Polished Concrete: As specified in Section - 03 35 33.
- H. Leveling Agent: Sonneborn Sonoflow, Euclid Flo-Top, Ardex K-15, L&M Construction Chemicals Levelx, US Spec "Self-Leveling Underlayment, or Dayton-Superior Levelayer 1 are acceptable products.
- I. Liquid Sealer Densifier: High performance, deeply penetrating concrete densifier; odorless, colorless, VOC compliant, non-yellowing silicone based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum solids content of 20 percent of which 50 percent is silicate.
1. Subject to project requirements provide one of the following products:
 - a. Ashford Formula, Curecrete Chemical Company, Inc. www.ashfordformula.com
 - b. Diamond Hard, Euclid Chemical Company www.euclidchemical.com .
 - c. SealHard, L&M Construction Chemicals www.lmcc.com
 - d. Liquihard, W. R. Meadows www.wrmeadows.com
 - e. J-17 Surehard, Dayton-Superior www.daytonsuperior.com
 - f. Industraseal, US Spec www.usspec.com "
 2. Liquid Densifier-Sealer for Ground and Polished Concrete: as specified in Section 03 35 33.
- J. Vapor Barrier: ASTM E1745, Meets or exceeds Class A, manufactured from prime virgin resins and complying with the following:
1. Permeance Rating:
 - a. New Material: Less than 0.01 perms (gr/ft²/hr/in-Hg) when tested in accordance to ASTM E96 or ASTM F1249.
 - b. After Mandatory Conditioning: Less than 0.01 perms (gr/ft²/hr/in-Hg) when tested in accordance with ASTM E154, Sections 8, 11, 12 and 13.
 2. Minimum Thickness: 15 mils in accordance with ACI 302.2R-06.
 3. Puncture Resistance: Minimum 2200 grams when tested in accordance with ASTM D1709.
 4. Tensile Strength: Minimum 45.0 lbf/in when tested in accordance with ASTM D882.
 5. Acceptable Products:
 - a. Stego Wrap (15 mil) vapor Barrier, Stego Industries, L.L.C., (877) 464-7834 www.stegoindustries.com
 - b. Vaporguard, Reef Industries www.reefindustries.com
 6. Accessories:
 - a. Seam Tape and Mastic: Provide manufacturer's recommended seam tape and vapor proofing mastic with WVTR of 0.3 perms or lower when tested in accordance with ASTM E96.
 - b. Pipe Boots: Construct boots from vapor barrier material, pressure sensitive tape and/or mastic in accordance with manufacturer's instructions.
 - c. Termination Bars: As recommended by manufacturer for terminating vapor barrier on vertical footings and foundation walls.

- K. Concrete Accessories: Gateway Engineering Company, Dayton-Superior Corporation, or Burke Concrete Accessories.
- L. Evaporation Retarder:
 - 1. Type: Monomolecular film, compatible with subsequent coatings and floor finishes.
 - 2. Acceptable Manufacturer and Products: L&M Construction Chemicals (E-Con), Master Builders (Confilm), Sika (Sika Film), W.R. Meadows (Evapre), US Spec (Monofilm ER), or Dayton Superior (Surefilm J-74)."

2.03 MIXES

- A. Design of Mixes: All mix designs shall be prepared in accordance with ACI 318-05, "Building Code Requirements for Structural Concrete", Section 5.3, "Proportioning on the Basis of Field Experience or Trial Mixtures".
- B. Selection of proportions for normal weight concrete: ACI 301.
- C. Fiber Reinforcement:
 - 1. Dosage: 5.0 lb. per cu. yd.
 - 2. Mix synthetic macrofibers at dosage to provide a minimum post-crack residual strength (f_{e3}) of 200 psi when tested according to ASTM C1609.
 - 3. Comply with recommendations of the fiber manufacturer for mix design.
- D. Mix and deliver ready-mixed concrete in accordance with requirements of ASTM C94, Option A.
 - 1. Not more than 90 minutes shall elapse from time water is introduced into the concrete mixture until completion of placement.
 - 2. Do not add water to mix that has stiffened to increase its workability.
 - 3. At no time shall concrete mix exceed a bulb thermometer reading of 90 degrees F. or over.
 - 4. Use ice or other method as reviewed by Architect, to keep concrete below 90 degrees F. temperature.
- E. All concrete must contain the specified water-reducing admixture or the specified high-range water-reducing admixture (superplasticizer). All thin concrete slabs, less than 8 inches in thickness placed at air temperatures below 50 degrees F shall contain the specified non-corrosive, non-chloride accelerator. All concrete slabs placed at air temperatures above 90 degrees F may require the use of a water reducing retarding admixtures.
- F. All concrete required to be air entrained shall contain an approved air entraining admixture. All pumped concrete, concrete for industrial slabs, synthetic fiber concrete, architectural concrete, self-consolidating concrete, concrete required to be watertight or concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).
- G. Durability Requirements - Water/Cementitious Ratio:
 - 1. All concrete subject to freezing and thawing shall have a maximum water/cementitious ratio of 0.50 (4000 psi at 28 days or more).
 - 2. Water-cement ratio for concrete used for interior slab on grade construction: 0.40 to 0.45.

- H. Air Entraining Admixture: All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 4.5 to 7.5 percent in accordance with ACI 212.3R. All interior, slabs subject to vehicular abrasion, shall have a maximum air content of 3 percent.
- I. Compressive strength (28 day): As shown on Structural Drawings.
- J. Slump, for consolidation by vibration: As shown on Drawings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prior to placing concrete:
 - 1. Clean equipment involved.
 - 2. Remove debris and foreign material from the forms.
 - 3. Remove concrete laitance from reinforcing steel.
 - 4. Wet wood forms and masonry units in contact with concrete.
- B. No wood will be permitted to remain permanently inside the forms.
- C. Coordinate the necessary Trades as required to provide the sleeves, bolts, anchors, holes, etc., to be built in.
- D. Place vapor retarder over subbase immediately prior to placing of floor slab.
 - 1. At locations indicated on Drawings, Install vapor retarder in accordance with ASTM E1643-11 and manufacturer's printed instructions.
 - 2. Unroll vapor barrier/retarder with the longest dimension parallel with the direction of the pour.
 - 3. Lap vapor barrier/retarder over footings or seal to foundation walls.
 - 4. Vapor barrier/retarder shall be continuous over entire floor area and turned up a minimum of 2 inches at perimeter walls and penetrations and sealed with termination bar.
 - 5. Overlap joints 6 inches and seal with manufacturer's tape.
 - 6. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 7. No penetration of the vapor barrier/retarder is allowed except for reinforcing steel, structural members and permanent utilities.
 - 8. Repair damaged areas by cutting patches of vapor barrier/retarder, overlapping damaged area 6 inches and taping all four sides with tape.
 - 9. Vapor barrier/retarder installation shall be approved by the vapor barrier manufacturer prior to concrete placement.

3.02 PLACING OF CONCRETE

- A. Concrete Work shall be performed in accordance with ACI-301 except as amended by this Section.
- B. Convey concrete from the mixer to place of final deposit by methods which will prevent segregation of aggregate or loss of material. Place concrete at such a rate that concrete is at all times plastic and to insure a practically continuous flow of concrete. Concrete not in place 1-1/2 hours after water has been added at batch plant may be rejected by Architect.
- C. Fiber Reinforced Concrete: Comply with recommendations of the fiber manufacturer for pumping and finishing practices.

- D. Place concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not deposit concrete that has partially hardened or been retempered.
- E. Do not place concrete during rain unless adequate protection has been provided.
- F. Thoroughly compact concrete by suitable means during the placing, and work around the reinforcement and embedded items into the corners of the forms.
 - 1. Use vibrators to aid in the placement of the concrete, operated by experienced personnel.
 - 2. Keep at least one spare operating vibrator on the job at all times during the concrete operations.
- G. Self-Consolidation concrete does not require vibration.
- H. Set reinforcing dowels connecting new concrete construction to existing with epoxy anchoring adhesive as indicated on Structural Drawings.

3.03 CONSTRUCTION, EXPANSION, AND CONTRACTION JOINTS

- A. Construction Joints: Provide as required to facilitate construction in accordance with reviewed shop drawings.
- B. Expansion and Contraction Joints: Place expansion and contraction joints where required to ensure that undesirable thermal and shrinkage cracking of slabs is minimized.
 - 1. See Drawings for locations of expansion and contraction joints in slabs-on-grade and in topping pours.
 - 2. If drawings do not indicate locations, verify with Architect prior to placement of slabs-on-grade and topping pours.
 - 3. Utilize early entry saw-cutting techniques using specialized equipment and procedures in accordance with the manufacturer of the saw-cutting equipment to saw-cut all joints in interior and exterior slabs within 2 hours of final finishing of the floor slabs while the concrete is still in its early green state.
 - a. Acceptable Equipment: Soff-Cut International, Inc., Corona, CA 1-800-776-3328 www.soffcut.com
 - 4. At exterior slabs-on-grade provide a 1/2 inch wide expansion joint wherever slabs abut vertical construction elements whether indicated or not.
- C. Additional reinforcing may be required at some construction, expansion/contraction and control joints, and shall be supplied and installed at no additional cost.
- D. Reinforcing shall be continuous through construction joints of reinforced slabs, unless otherwise indicated on Drawings. Placement schedule shall be submitted for approval.
- E. For slabs-on-grade, no concrete pour shall be longer than 100 feet or more than 4,000 square feet in area, unless early entry saw-cutting techniques are utilized for placement of joints in the slab while the concrete is still in a green state and prior to the slab developing expansion/contraction cracking at random location. Provide shear keys as detailed.
- F. Provide support of formed construction joint materials by means that does not puncture or otherwise damage under floor vapor retarder at interior floor slabs on grade.

3.04 FINISHING VERTICAL (FORMED) SURFACES

- A. Formed surface finishes:
 - 1. Pits, tunnels, mechanical rooms and concealed surfaces: Remove fins, patch tie holes.
 - 2. Interior and exterior exposed surfaces: Remove fins, patch tie holes, stone joint marks, out-of-plane surfaces and other projections to produce uniform, smooth, dense concrete having the following formed finish Class and permitted abrupt or gradual irregularities as designated by ACI 347-04:
 - a. Vertical and horizontal exterior exposed surfaces: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
 - b. Other surfaces prominently exposed to public view: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
 - c. Concealed surfaces where covered by another finish: Class C, 1/2 inch, except abrupt irregularities shall be limited to 1/4 inch.

3.05 FINISHING HORIZONTAL SURFACES

- A. Rake concrete into place, screed and compact with a light tamp, except do not tamp topping and slabs not on grade. Screed with sawing motion and float surface to bring fines to the top.
- B. Mix and apply evaporation retarder in accordance with manufacturer's printed instructions immediately after floating. In extreme drying conditions, apply additional material as needed. Apply lightly on hard to trowel floor areas.
- C. Concrete Flatwork (Slab) Finishes:
 - 1. Interior Flatwork Concrete:
 - a. Sealed, smooth steel trowel finish.
 - b. Ground and polished concrete as specified in Section 03 35 33.
 - 2. Exterior Flatwork: As follows, unless otherwise indicated on Drawings:
 - a. Natural color medium and rough broom finish concrete as indicated on Drawings.
- D. When concrete has hardened sufficiently so that excess fines will not be brought to the surface, trowel slab with a steel trowel to a smooth surface free of pinholes and other imperfections. A mechanical trowel with rotating steel blades, approved by Architect, shall be used for this operation.
- E. After the surface has hardened sufficiently to ring under a trowel, trowel again with a steel trowel to a hard, burnished surface free of blemishes.
- F. Concrete slabs scheduled to receive ceramic or stone tile, concrete topping or similar finishes shall have a screeded finish but true and even to plane with no sharp projections or ridges.
- G. Use a 1/8 inch radius edger on edges of exposed Work. Use a deep cutting, 1/8 inch radius scoring tool or sawcutting to provide scoring for control joints as indicated unless otherwise noted or directed.
- H. Finish floors shall meet requirements of ACI 302.1R for a Flat (3/16 in 10'-0") Classification. Floors scheduled to receive thin-set tile shall meet Very Flat (1/8 inch in 10'-0") Classification.

3.06 SLABS

- A. Saw cut or score contraction joint pattern indicated on Drawings. Use thick blade or scoring tool. Early entry saw shall be used immediately after final finishing and to a depth of 1-1/4 inches. A conventional saw or scoring tool shall cut 1/4 of the depth of slab thickness.
- B. Slope to drains to drains as indicated on Drawings, but not less than 1/4 inch per foot nominal across entire room or area to be drained.

3.07 SPECIAL FINISHES

- A. General:
 - 1. Obtain cement and aggregates from a single source for specialty concrete finishes to provide uniformity in appearance and color.
 - 2. Place concrete containing the high range water reducing admixture at a maximum slump. Flow or pump concrete into place, screed, strike-off and float. Do not tamp.
- B. Ground and Polished Concrete: As specified in Section 03 35 33 – Decorative Concrete Finishes.

3.08 REPAIR OF SURFACE DEFECTS

- A. Modify or replace concrete not conforming to required lines, detail and elevations. Grind high spots and fill low areas as required to provide finished floor tolerances as required for application of finish floor materials.
- B. Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects. Do not patch, repair or replace exposed architectural concrete except upon express direction of Architect.
- C. After forms are removed, fill tie rod holes, correct honeycomb spots, remove fins and clean and finish damaged surfaces. Wipe off excess mortar and rub to match adjoining surfaces.
- D. When excessive honeycombing is revealed, remove the defective material immediately after stripping forms to a depth of 3/4 inch to 1 inch. Cut edge of area perpendicular to surface to avoid feathered edges. Repair using the following method or submit method of repair and patching material to Architect and Structural Engineer for approval.
 - 1. Saturate with water for several inches beyond cutout and brush-in a grout consisting of equal parts Portland cement and sand. Follow immediately with the patching mortar. Leave the patch slightly higher than the surrounding surface. After an hour or two, finish flush with the adjoining surface. Wipe and rub patch to match adjoining surfaces. Keep patches moist for 7 days.
 - 2. Patching mortar shall consist of the same materials and proportions as the original concrete except that the coarse aggregate shall be omitted. When color match is required, adjust mixture to produce a finished color to match the adjoining concrete surfaces.
- E. Cracks caused by expansion, shrinkage and the like that occur in natural color concrete up through final acceptance of building shall be carefully repaired by epoxy injection or other method approved by the Architect.

3.09 CURING

- A. Protect freshly deposited concrete from premature drying and maintain without drying at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.
- B. Curing Methods: Cure concrete surfaces receiving finish materials, including, but not limited to; cementitious toppings, paint, and flooring, using one of the following two methods immediately after finishing operations. Consideration shall be given to the construction schedule impact and the compatibility of finish materials with the concrete when selecting a method.
 - 1. Keep concrete continuously moist for at least 7 days using polyethylene film, liquid membrane forming curing compound, or other acceptable covering. Interior floor slabs on grade shall be continuously moist cured for a minimum of 7 days in accordance with ACI standards.
 - 2. Liquid curing compounds shall not be acceptable unless it has been demonstrated that curing compound can satisfactorily serve as a base for finish materials or removed, resulting in a satisfactory base for adhesion of finish materials.
 - 3. Where approved for use, apply liquid curing compound in accordance with the Manufacturer's printed instructions.
 - 4. Refer to Structural Drawings for other acceptable curing procedures.
- C. Prevent rapid drying of the concrete at the end of the curing period.
- D. During the curing period, protect the concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibrations. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods.

3.10 UNDERLAYMENT OR REPAIR TOPPING

- A. Apply underlayment or repair topping to correct unsatisfactory floor surface due to undue settlement or failure to meet tolerance requirements.
- B. Slab surface preparation and placing procedures shall be approved by the underlayment and/or repair topping manufacturer and Architect prior to start of installation.
- C. Installation: Install underlayment and/or repair topping materials in accordance with Manufacturer's published instructions and recommendations.

3.11 FLOOR SEALER

- A. At areas indicated on Drawings, provide 2 coats of sealer.
- B. Surface must be clean, dry and free of loose dirt, oil, wax, curing and parting compounds and other foreign matter.
- C. Apply each coat in accordance with Manufacturer's printed instructions.

3.12 LIQUID SEALER DENSIFIER

- A. Where indicated on Drawings, provide one coat of liquid sealer densifier.
- B. Clean and prepare concrete floors to receive liquid sealer densifier in accordance with manufacturer's printed instructions.

- C. Concrete slabs to receive liquid sealer densifier shall be properly cured in accordance with recommendations of the liquid sealer densifier manufacturer's recommendations.
- D. Application shall be made in strict accordance with manufacturer's printed instructions and just prior to completion of construction.
 - 1. Spray, squeegee or roll-on liquid sealer densifier to clean, dry concrete surface.
 - 2. Scrub liquid into concrete surface with a mechanical scrubber.
 - 3. Keep surface wet with sealer densifier during the application process.
 - 4. When product thickens, but not more than 60 minutes after initial application, squeegee or vacuum surface to remove all excess liquid.
- E. Apply each coat in strict accordance with Manufacturer's instructions.

3.13 FIELD QUALITY CONTROL

- A. Tests: Inspection and testing of concrete mix will be performed by a testing laboratory in accordance with Section 01 45 00.
 - 1. Provide free access to Work and cooperate with appointed firm.
 - 2. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
 - 3. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 4. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 - 6. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - 7. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - 8. Take one additional test cylinder during cold weather concreting, and cure on job site under same conditions as concrete it represents.
 - 9. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed. .
 - 10. Concrete which does not meet the compressive strength requirement at 28 days will be rejected and removed from the Project, and disposed of in a legal manner.
- B. Calcium chloride test requirements:
 - 1. Two weeks before installation of the ceramic tile, VCT, vinyl, wood, carpet, epoxy flooring and/or other finish flooring systems over the interior concrete slabs, provide calcium chloride test to determine the level of water vapor transmission in the slab.
 - 2. Conduct testing in accordance with ASTM F1869 or ASTM E1907 (quantitative anhydrous calcium chloride test).

3. Conduct calcium chloride tests after HVAC system has been in continuous use for 36 hours with a minimum ambient temperature of 72 degrees F. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature is NOT acceptable.
4. Document test results and provide copy to Architect with a marked up floor finish plan showing test results.
5. Provide a written clarification on status of HVAC system before and during the test and the length of time the ambient air temperature was maintained before the tests.

3.14 PROTECTION

- A. Protect finished surfaces from stains or abrasions. Protect surfaces or edges by leaving forms in place or by providing temporary covers. Protect concrete from rain, flowing water or mechanical injury.
- B. Protect floor slabs from the droppings of plaster, paint, dirt, and other marring by covering with polyethylene plastic sheet, or other acceptable floor protection covering, well lapped and sealed.
 1. Where concrete slabs are scheduled to be the finished floor surface, or where slab is treated with a special concrete finish serving as the finished floor surface, provide a continuous covering of 1/2 inch particle board, joints tightly butted and cut to sizes tight to wall construction, over entire floor area over polyethylene plastic sheet, or other acceptable floor protection sheeting. Maintain covering (polyethylene and particleboard) in good condition until danger of damage is past.

3.15 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 03 35 33

DECORATIVE CONCRETE FINISHES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Bonded abrasive polished (ground and polished) concrete for interior floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-in-Place Concrete and related section for forming, reinforcing and concrete materials.

1.02 DEFINITIONS

- A. Terminology: As defined by the Concrete Polishing Association of America (CPAA).
- B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPAA.

1.03 SUBMITTALS

- A. In accordance with Section 03 30 00 - Cast-In-Place Concrete, and the following:
 - A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
 - B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in "Quality Assurance" Article.
 - C. Field Quality Control: Reports of testing specified in "Field Quality Control" Article.
 - D. Maintenance Data: For inclusion in maintenance manual required by Division 01. Include the following:
 - 1. Instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

- A. Polisher Qualifications:
 - 1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 - 2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level I or higher by CPAA.
 - 3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

- B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.

- C. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
 - 1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
 - 2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

- D. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.
 - 1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
 - 2. Concrete shall be same mix design as scheduled for Project.
 - 3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
 - 4. Mock-up shall be representative of work to be expected.
 - 5. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
 - 6. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified aggregate exposure.
 - c. Compliance with specified finished gloss level.
 - 7. Obtain Architect's approval before starting work on Project.
 - 8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

- E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
 - 1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including supervisor.
 - d. Concrete producer.
 - e. Concrete finisher, including supervisor.
 - f. Concrete polisher, including supervisor.
 - g. Technical representative of liquid applied product manufacturers.
 - h. Walkway auditor.

2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
 - b. Review Contract Document requirements.
 - c. Review approved submittals and field mock-up.
 - d. Review procedures, including, but not limited to:
 - 1) Applicable Division 03 Section on cast-in-place concrete.
 - a) Specific mix design.
 - b) Specified curing methods/procedures.
 - c) Projected 3, 10, and 28 day compression strength test related to specified aggregates exposure for finished floor and project phasing.
 - d) Protection of concrete substrate during construction and prior to polishing process.
 - e) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
 - i. Quality of qualified personnel committed to project.
 - ii. Quality and size of grinders committed to project.
 - iii. Proper disposal of concrete slurry and/or concrete dust.
 - f) Details of each step of grinding, honing, and polishing operations.
 - i. Application of liquid applied products.
 - ii. Protecting polished concrete floors after polishing work is complete.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.05 FIELD CONDITIONS

- A. Concrete Work: In accordance with Section 03 30 00 - Cast-In-Place Concrete.
- B. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
 1. Prohibit use of markers, spray paint, and soapstone.
 2. Prohibit improper application of liquid membrane film forming curing compounds.
 3. Prohibit vehicle parking over concrete surfaces.
 4. Prohibit pipe-cutting operations over concrete surfaces.
 5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
 6. Prohibit ferrous metals storage over concrete surfaces.
 7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
 8. Protect from acids and acidic detergents contacting concrete surfaces.
 9. Protect from painting activities over concrete surfaces.
- C. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS AND ACCESSORIES

- A. Concrete Materials and Accessories: In accordance with Section 03 30 00 - Cast-In-Place Concrete.
- B. Reinforcement: As specified in Section 03 20 00.

2.02 DECORATIVE CONCRETE FINISH MATERIALS AND ACCESSORIES

- A. Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. Subject to project requirements provide one of the following products:
 - 1. Ashford Formula, Curecrete Chemical Company, Inc. www.ashfordformula.com
 - 2. Diamond Hard, Euclid Chemical Company www.euclidchemical.com .
 - 3. SealHard, L&M Construction Chemicals www.lmcc.com
 - 4. Liquihard, W. R. Meadows www.wrmeadows.com
 - 5. J-17 Surehard, Dayton-Superior www.daytonsuperior.com
 - 6. Industraseal, US Spec www.usspec.com
 - 7. Scofield Lithium Silicate Concrete Densifier, L.M. Scofield Company www.scofield.com
- B. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.
- C. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
 - a. Epoxy, urethane, polyurea, or polyaspartic resins.
 - b. Latex or acrylic binders mixed with cement dust from previous grinding steps.
 - c. Silicate binders mixed with cement dust from previous grinding steps.
- D. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.03 POLISHING EQUIPMENT

- A. Field Grinding and Polishing Equipment:
 - 1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 - 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
 - 3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

- D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.
1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
 2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
 3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
 4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
 5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
 6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

2.04 CONCRETE MIX DESIGN

- A. Concrete Mix Design: As specified in Section 03 30 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
 - a. Concrete Finished Floor Flatness in accordance with Section 03 30 00 - Cast-In-Place Concrete.
 - b. Concrete curing methods in accordance with Section 03 30 00 - Cast-In-Place Concrete.
 - c. Concrete Compression strength in accordance with Section 03 30 00 - Cast-In-Place Concrete and General Structural Notes on Drawings.
- B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

- C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 PREPARATION

- A. Concrete Work: In accordance with Section 03 30 00 - Cast-In-Place Concrete and related Sections.
- B. Cleaning New Concrete Surfaces:
 - 1. Prepare and clean concrete surfaces.
 - 2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.03 DECORATIVE CONCRETE FINISHES - GENERAL

- A. Concrete placement, construction joints, expansion joints, contraction joints, and Initial slab finishing shall be in accordance with Section 03 30 00 prior to Work of this Section.

3.04 BONDED ABRASIVE POLISHED (GROUND AND POLISHED) CONCRETE

- A. Perform all polishing procedures to ensure a consistent appearance from wall to wall.
- B. Initial Grinding:
 - 1. Use grinding equipment with metal or semi-metal bonded tooling.
 - 2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
 - 3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
 - 4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
 - 5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 - 6. Continue grinding until aggregate exposure matches approved field mock-ups.
- C. Treating Surface Imperfections:
 - 1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
 - 2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
 - 3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.
- D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturers instructions.
- E. Grout Grinding:
 - 1. Use grinding equipment and appropriate grit and bond diamond tooling.
 - 2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
 - 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

- F. Honing:
1. Use grinding equipment with hybrid or resin bonded tooling.
 2. Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- G. Polishing:
1. Use polishing equipment with resin-bonded tooling.
 2. Begin polishing in one direction starting with 800 grit tooling.
 3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
 4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
 5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 6. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
 7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.
- H. Final Polished Concrete Floor Finish: Comply with the following, unless otherwise indicated on Drawings or selected by Architect. Final aggregate exposure and finished gloss level shall be in accordance with approved Field Sample. Provide the following levels of finish as scheduled on Drawings:
1. Coarse Aggregate with Medium Gloss:
 - a. Aggregate Exposure Class C – Coarse Aggregate: Surface exposure of 80 to 90 percent coarse aggregate and 10 to 20 percent cement fines and fine aggregate based on visual observation of the overall area of the polished floor.
 - b. Appearance Level 3 – Polished (Medium Gloss 800):
 - 1) Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
 - 2) Measurement: Determine the Image Clarity Value, Percent, and the Haze Index:
 - a) Image Clarity Value, Percent: An average value of 40 to 69 measured in accordance with ASTM D5767 prior to the application of sealers.
 - b) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
 - c) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 sq. ft. and one additional test for each 1000 sq. ft. or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

2. Salt & Pepper Aggregate with High Gloss:
 - a. Aggregate Exposure Class A – Cement Fines: Surface exposure of 85 to 95 percent cement fines and 5 to 15 percent fine aggregate based on visual observation of the overall area of the polished floor.
 - b. Appearance Level 4 –Highly Polished (High Gloss 1500):
 - 1) Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
 - 2) Measurement: Determine the Image Clarity Value, Percent, and the Haze Index:
 - a) Image Clarity Value, Percent: An average value of 70 to 100 measured in accordance with ASTM D5767 prior to the application of sealers.
 - b) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
 - c) The minimum number of tests distributed across the polished surface should be three for areas up to 1000 sq. ft. and one additional test for each 1000 ft sq. ft. or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

3.05 FIELD QUALITY CONTROL

- A. In accordance with Section 03 30 00 - Cast-In-Place Concrete, and the following.
- B. Field Testing: Engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction;
 1. ANSI B101.1 for static coefficient of friction.
 2. ANSI B101.3 for dynamic coefficient of friction

3.06 MAINTENANCE AND PROTECTION

- A. Maintenance Training: CPAA Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.
- B. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION

SECTION 03 37 13

SHOTCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes shotcrete applied by the wet-mix process for application to earth slopes for slope protection.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete
 - 2. Section 32 00 00 – Earthwork.

1.02 DEFINITIONS

- A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
- B. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.03 SUBMITTALS

- A. Product Data: For manufactured materials and products including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
- B. Design Mixes: For each shotcrete mix.
- C. Installer Qualifications.
- D. Material Test Reports: For shotcrete materials.
- E. Material Certificates: For each material item, signed by manufacturers.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer with a minimum of five years of experience in similar projects employing ACI 660 Qualified nozzlelemen.
- B. Comply with provisions of the following, unless more stringent requirements are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 506.2, "Specification for Shotcrete."
 - a. The word "shall" shall be substituted whenever the word "should" occurs in ACI 506R-05.
 - b. CRSI's "Manual of Standard Practice."
 - 3. Shotcrete construction shall comply with all requirements of Section 1910 of the 2012 IBC with local amendments.
- F. Field Sample: Before application of shotcrete, construct field sample for each design mix, shooting orientation, and nozzle operator to demonstrate finished architectural surface Finish Class and quality.
 - 1. Location: As directed by Architect.

2. Approved field sample may become part of the completed Work if undamaged at time of Substantial Completion.
3. When not approved as part of the finish Work, dismantle and remove mock-ups from Project site when directed by Architect.

1.05 PROJECT CONDITION

- A. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:
 1. Discontinue shotcreting when ambient temperature is 40 deg F and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F and not more than 90 deg F.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
 4. Do not use calcium chloride, salt, and other materials containing antifreeze agents.
- B. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
 1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 90 deg F for wet mix.
 2. Decrease temperature of reinforcing steel and receiving surfaces below 100 deg F before shotcreting.
- C. Suspend shotcrete operations during high winds, rainy weather, or near freezing temperatures when work cannot be protected.

PART 2 PRODUCTS

2.01 SHOTCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type II, unless otherwise indicated on General Structural Notes on Drawings. Use only one brand and type of cement for Project.
 1. Fly ash admixture: In accordance with Section 03 05 05.
 2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- B. Silica Fume: ASTM C1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C33, from a single source, and as follows:
 1. Aggregate Gradation: ACI 506R, Gradation No. 2 with 100 percent passing 1/2-inch sieve.
 2. Coarse-Aggregate Class: 1N.
- D. Water: Potable, complying with ASTM C94, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.

2.02 CHEMICAL ADMIXTURES

- A. General: ASTM C1141, Class A or B, but limited to the following admixture materials. Provide admixtures for wet-mix shotcrete that contains not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
 - 1. Air-Entraining Admixture: ASTM C260.
 - 2. Water-Reducing Admixture: ASTM C494, Type A.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 - 6. Accelerating Admixture: ASTM C494, Type C.

2.03 REINFORCING

- A. Welded Wire Mesh: In accordance with 03 20 00.

2.04 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

2.05 SHOTCRETE MIXES, GENERAL

- A. Prepare design mixes for each type and strength of shotcrete. Mix designs shall be designed and signed by a qualified structural engineer.
 - 1. Limit use of fly ash to not exceed, in combination, 25 percent of portland cement by weight.
- B. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
- C. Admixtures: When included in shotcrete design mixes, use admixtures and retarding admixtures according to manufacturer's written instructions. Mix designer shall include type of acceptable admixtures, dosage rates, and permissible combinations of admixtures in the mix design documentation.
- D. Design-Mix Adjustments: Subject to compliance with requirements, shotcrete design-mix adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.06 NORMAL-WEIGHT SHOTCRETE MIXES

- A. Proportion wet mixes according to ACI 211.1 and ACI 301, using materials to be used on Project, to provide normal-weight shotcrete with the following properties:
 - 1. Compressive Strength (28 Days): As indicated on Drawings.

2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight, wet-mix shotcrete having an air content before pumping of 5 percent with a tolerance of plus or minus 1 percent.
3. The minimum slump shall be 1-1/2 inch and the maximum slump shall be 2-1/2 inches. Slump shall be measured at the point of discharge from the mixer, except the Building Inspector may require slump tests at the discharge point where water may have been added.
4. Thoroughly mix shotcrete. Use mix within 45 minutes.

2.07 SHOTCRETE EQUIPMENT

- A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
- B. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.08 BATCHING AND MIXING

- A. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C94 and furnish batch ticket information.

PART 3 EXECUTION

3.01 PREPARATION

- A. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces before shotcreting.
- B. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding.

3.02 REINFORCING

- A. Set and secure welded wire mesh reinforcing on grade in accordance with Section 03 20 00.

3.03 JOINTS

- A. Construction Joints: Construction joints shall only be placed vertically.
- B. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch-wide-by-1/3 slab depth.
 1. Space joints at 15 feet o.c. horizontally, unless otherwise indicated in the contract drawings.

3.04 APPLICATION

- A. General: Wet mix shotcrete shall not be placed where the stream from the nozzle cannot directly impinge on the surface on which the concrete is to be placed. Where the condition precludes the possibility of obtaining cores from the structure, this method shall not be used.
- B. Do not place shotcrete on any surfaces that are frozen, spongy, or where there is free water.

- C. Apply shotcrete according to ACI 506.2.
- D. Apply wet-mix shotcrete materials within 90 minutes after batching.
- E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
 - 1. A capable nozzleman's helper shall remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment. Additional workers may be required to take the rebound from the work if the rebound cannot be removed by an air blow pipe.
- F. Do not permit shotcrete to sag, slough, or dislodge.
- G. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
- H. Do not disturb shotcrete surfaces before beginning finishing operations.
- I. Continuously remove rebound material to ensure that base, intermediate, and finish surfaces are clean and ready for bonding layers.
- J. Do not reuse rebound or overspray.

3.05 SURFACE FINISHES

- A. Finishing: Provide exposed surface finish indicated on Civil and/or Landscape Drawings, or as otherwise approved by Landscape Architect.

3.06 CURING

- A. Environmental Protection:
 - 1. Protect shotcrete from rain until it obtains its final set (usually 4-5 hours).
 - 2. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing.
- C. Curing Exposed Surfaces: Cure shotcrete by the following methods:
 - 1. Keep shotcrete continuously moist by direct water application for 24 hours after placement.
 - 2. Moisture Curing: Follow by curing shotcrete by keeping surfaces continuously moist for at least seven days with continuous water-fog spray or with approved moisture-retaining cover, membrane, or compound. Lap and seal sides and ends of covers.
 - 3. Curing Compound: Apply curing compound uniformly in continuous operation by power spray 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.
 - a. Apply curing compound at twice the manufacturer's specified coverage.

3.07 FIELD QUALITY CONTROL

- A. Shotcrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and 1 test for each set of compressive-strength specimens.
- B. Compressive Strength:
 - 1. Test each concrete mix and for each workday, or for every 50 cu. yd. of shotcrete placed, whichever is less.
 - 2. Test each set of unreinforced specimens for compressive strength according to ASTM C1140 and construction testing requirements in ACI 506.2.
 - 3. Strength of shotcrete will be considered satisfactory when mean compressive strength of each set of 3 unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
 - 4. Mean compressive strength of each set of 3 unreinforced cores shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

3.08 REPAIRS

- A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.
 - 1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces and apply new shotcrete.
- B. For shotcrete placed against earth, in the event that a previously presumed solid embankment should slough or shed dirt in sufficient quantity to damage the concrete, the wet mix shotcrete placement work in that area shall cease until a rigid backing is installed and any contaminated shotcrete is removed.
- C. Repair core holes from in-place testing according to repair provisions in ACI 301 and match adjacent finish, texture, and color.

3.09 CLEANING AND PROTECTION

- A. Remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.
- B. Protect finished installation. Immediately after placement, protect shotcrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 04 01 20.52

UNIT MASONRY CLEANING

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Performance Requirements: The application of chemical cleaner shall leave the finished surfaces uniform in color and shall not alter the natural texture of the masonry units.

1.02 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Engaged in producing materials with a satisfactory performance record for at least 5 years.
 2. Applicator: Trained, approved and accepted by the cleaning compound manufacturer. Application personnel shall have at least 2 years experience with the particular materials being applied.
- B. Field Samples:
1. A test area of wall surface from 10 to 20 square feet in size shall be cleaned with the chemical cleaner recommended by the cleaning compound manufacturer for acceptance by the Architect.
 2. Test samples of adjacent non-masonry materials for possible reaction with the diluted cleaning materials. Samples to be available for review by the Architect.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Delivery shall be made to the job site in manufacturer's original containers with seals unbroken and labeled with manufacturer's batch number.
- B. Storage and Protection:
1. Store materials in original, unopened containers in compliance with manufacturer's printed instructions.
 2. Do not store in areas where temperature will fall below 20 degrees F. or rise above 100 degrees F..

1.04 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Temperature and relative humidity conditions for a period before, during and after application shall be as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Chemical Cleaner:
1. Cleaner shall be a solution of blended liquid acids, heavily inhibited and emulsified and in combination with special wetting systems.
 2. Specific product selection shall be dependent upon substrate as recommended by the chemical cleaner manufacturer.
 3. Cleaner shall be acceptable to the masonry unit manufacturer.
 4. Muriatic acid shall not be acceptable as a chemical cleaner for new masonry.

5. Subject to compliance with specification requirements, Sure-Klean Vana Trol, Sure-Klean No. 600 Detergent and Sure-Klean 101 Lime Solvent as manufactured by ProSoCo, Inc., www.prosoco.com or 202V Vana-Stop , 202 New Masonry Detergent and 200 Lime Solve as manufactured by Diedrich Technologies www.diedrichtechnologies.com are acceptable products.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 1. Prior to start of work, carefully inspect the installed work of other trades, and verify that such work is complete to the point where this work may commence.
 2. The chemical cleaner manufacturer's representative shall verify that the chemical cleaner may be applied in accordance with the manufacturer's recommended methods.
 3. In the event of discrepancy, immediately notify the Architect.
 4. Commencement of system application constitutes acceptance of surfaces by applicator.

3.02 PREPARATION

- A. Protection:
 1. Use all means necessary to protect the installed work of other trades.
 2. Concrete sidewalks shall be protected from runoff by soaking with water immediately prior to application on adjacent walls.
 3. Adjoining glass, metal and painted surfaces shall be protected from overspray and splash of chemical cleaner. Inadvertent splashes shall be removed in an approved manner before the solution has damaged the surface.
 4. In the event of damage, immediately make all repairs and replacements necessary to the approval of Architect and at no additional cost to Owner.
- B. Surface Preparation for Chemical Cleaner:
 1. In strict accordance with manufacturer's printed instructions.
 - a. Masonry walls shall be cleaned within 14 to 28 days after installation.
 - b. Walls shall be free of excess mortar.
 - c. Cracks, other than hairline cracks, shall be pointed up.
 - d. Defective mortar joints shall be routed out, pointed with mortar and tooled.
 2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
- C. Presoaking Hoses:
 1. Adequate water supply shall be made available to assure thorough pre-soaking and thorough rinsing of the wall before undertaking general cleaning.
 2. Two water hoses shall be used by the cleaning crew.
 3. One hose shall be attached to a length of lawn soaker hose placed along the top of the wall to provide a uniform and complete saturation of the entire wall area.
 4. The second hose shall provide a copious flow of water for thorough flushing of excess mortar and dirt from the scrubbed areas.
 5. The lawn soaker hose is later to be placed at the face of the scaffold or stage to provide a continuous spray of wall areas below the working area.

3.03 APPLICATION

- A. Chemical Cleaner: Application to be in strict accordance with manufacturer's printed instructions and as follows:
1. Surfaces shall be thoroughly pre-soaked with clean water to prevent the absorption of the cleaning solution within the pores of the masonry.
 2. Cleaning solution shall be diluted with clear water and applied to pre-soaked wall areas with a long handled stiff fibered masonry wall washing brush, or other brush as recommended by the cleaning compound manufacturer. The cleaning solution may also be applied with a garden-type low pressure sprayer having a maximum nozzle pressure of 50 psi (3.5kg/cm²). Allow the solution to remain on the wall 5 to 10 minutes, or as recommended by the cleaning solution manufacturer. Wooden paddles or other non-metallic tools may be used to remove stubborn particles. Cleaning shall be restricted to small areas of up to 20 square feet at a time.
 3. After washing a given area, the wall shall be flushed with a copious amount of clear water, working from top to bottom, before the solution dries on the wall surface. All of the cleaning solution shall be completely rinsed off of the wall.
 4. Rinsing water may be applied with a high-pressure hose system with a maximum nozzle pressure of 700 psi . The high-pressure nozzle tips shall have a fan spray angle of from 15 to 45 degrees. The high-pressure system shall have a water flow rate of 3 to 8 gallons per minute. Care shall be taken to avoid damaging the brick unit or the mortar joints with the high-pressure water spray.
 5. Repeat the procedure on spots which require additional cleaning.
 6. Clean roof side and top of parapet walls.

END OF SECTION

SECTION 04 05 15

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Mortar and masonry grout used in concrete unit masonry construction as shown on Drawings and as specified.

1.02 SUBMITTALS

- A. Mix Designs:
 - 1. Submit mix designs and samples to the Architect for review prior to delivering materials to the site or commencing the Work.
 - a. Mortar Mix Design: Furnish in accordance with ASTM C270.
 - b. Grout Mix Design: Furnished by either the grout supplier or an independent testing laboratory. Submit comprehensive strength data with mix design submittals when pozzolans are used.
 - 2. Submit written colored mortar proportions for each color of mortar to be supplied for review by the Architect.
- B. Samples: Submit mortar channels for color selection.
- C. Product Data: If alternative mortar materials are to be provided, submit current instructions stating the actual quantities and mixing instructions for alternative mortar materials to conform to specified requirements.
 - 1. Submit test report data substantiating compliance with specified performance requirements.
 - 2. Submit current ICC Evaluation Report.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Cementitious materials shall be stored off the ground, under cover and shall be kept dry.
- B. Preblended Mortar Mix Delivery System: The use of dry preblended mortar silos and bulk bags shall be acceptable. Bulk bags and silos shall be sealed to prohibit contamination of the ingredients and to keep the materials dry until mixed.

1.04 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Hot Weather Requirements: Wet mortar board before loading and cover mortar to retard drying when not being used.
 - 2. Cold Weather Requirements: In accordance with "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction" by IMIAC; provide adequate equipment for heating the mortar and grout materials, when air temperature is below 40 degrees F.. Temperatures of the separate materials, including water, shall not exceed 140 degrees F. when placed in the mixer. When air temperature is below 32 degrees F., maintain mortar temperature on boards above freezing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mortar:

1. Cement: Type II Portland cement conforming to ASTM C150.
2. Aggregate: Clean, sharp and well graded and free from injurious amounts of dust, lumps, shale, alkali, surface coatings and organic matter, conforming to ASTM C144, except that no less than 3 percent nor more than 10 percent shall pass a No. 100 sieve.
3. Hydrated Lime: ASTM C207, Type S.
4. Water: Clean and potable.
5. Admixtures:
 - a. Chemical: The use of accelerator admixtures, water reducing plasticizers and other chemical admixtures shall not be allowed.
 - b. Mineral: In accordance with Section 03 05 05.
 - c. Water-Repellent Admixture: In accordance with Section 04 05 26.
 - d. Alternative Plasticizer: Pozzolanic formulation consisting of a combination of hydroxy aluminum silicates and diatomite:
 - 1) Alternative Plasticizer Manufacturer: Engaged in producing materials with a satisfactory performance record for at least 5 years.
 - 2) Mortar mix design shall be in accordance with ICC Evaluation Report, in accordance with the mortar type specified elsewhere in this specification.
 - 3) Provide alternative plasticizer in accordance with manufacturer's printed instructions, including specific mixing instruction.
 - 4) No other admixtures shall be used in conjunction with the alternative plasticizer unless approved in writing by the alternative plasticizer manufacturer.
 - 5) Packing and Shipping: Mortar admixture(s) shall be delivered to the job site in manufacturer's original containers with seals unbroken and labeled with manufacturer's batch number.
6. Mortar Color:
 - a. Color: Matching integral colored masonry units as approved by Architect.
 - b. Provide limeproof, inorganic compounds which shall not exceed 15 percent by weight of the cement, unless otherwise directed by Manufacturer.
 - c. Carbon black shall not exceed 3% by weight of the cement.
 - d. Factory blend color for full color saturation of mortar joint and factory package for unitized jobsite mixing at a ratio of one unit of color per sack of cementitious material, (portland cement, lime, or masonry cement).

B. Grout:

1. Cement: Type II Portland cement conforming to ASTM C150.
2. Aggregate: ASTM C404 and as follows:
 - a. Sand: Size No. 1 for fine aggregate.
 - b. Pea Gravel: Size No. 8 for coarse aggregate.
3. Water: Clean and potable.

2.02 MIXES

- A. Mortar: ASTM C 270, Type S.
1. Measurement: Accurately measure materials by ASTM C270 by the Property Method per Table 2.
 2. Mix cementitious materials and aggregates 3 to 5 minutes in a mechanical mixer. Small amounts of mortar may be mixed by hand. Adjust consistency of the mortar depending on the absorptive quality of the units being laid, and to the satisfaction of the mason.
 3. If mortar begins to stiffen, it may be retempered by adding water within a basin formed by the mortar, and remixing.
 4. Use within 2-1/2 hours of initial mixing and no mortar shall be used after it has begun to set or after it has become harsh or non-plastic.
 5. Mix color in a specific and exacting ratio in accordance with the Architect's reviewed submittals.
 6. Water-Repellent Admixture: In accordance with Section 04 05 26.
 7. Preblended Mortar Mix: Provide mortar as specified herein, except that dry ingredients may be preblended and bulk packaged for delivery to a jobsite silo (which loads into batch mixer) or bagged for hand loading into mixer. Moisture shall be extracted from sands. Digital printouts displaying the proportions of each batch shall be submitted to the Architect upon request. Mixing shall be accomplished by mechanical mixer in accordance with instructions provided by Preblended Mortar Mix Distributor.
- B. Grout:
1. Job-Site Mixed: In accordance with ASTM C476.
 2. Transit-Mixed:
 - a. Designed by the supplier or an independent testing laboratory with a minimum compressive strength of 2000 psi (140mPa) in 28 days, unless higher strength is required by the Structural Drawings and Notes.
 - b. Slump: Not to exceed 8 inches, unless otherwise noted on Drawings.
 - c. Use within 1-1/2 hours of initial mixing and use no grout after it has begun to set or after it has become harsh or non-plastic.
 - d. Course grout may be used in cavity walls with a horizontal dimension of 2 inches or more, and in hollow cell construction 4 inches or more in both horizontal directions.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of mortar and grout shall be as specified under each of the following Sections and in accordance with AMG Standard 108:
1. Section 04 22 00 – Concrete Unit Masonry.
- B. Colored Mortar: Consistency of appearance shall be maintained throughout the Project.
- C. Temperature: Mortar and grout shall have a temperature between 50 degrees F. and 90 degrees F. while being used.
- D. Grout may be poured by hand bucket, concrete hopper or through a grout pump. Grout spaces shall not be wet down prior to pouring grout.

3.02 FIELD QUALITY CONTROL

- A. General: Tests and inspections as necessary to verify quality and strength of mortar and grout. Laboratory tests shall conform to applicable ASTM standards and tests.
- B. Tests:
 - 1. Frequency: As determined by the Architect based upon total time for construction of masonry with not less than two tests per each level of masonry construction, foundation to roof or floors.
 - 2. Testing Laboratory: Inspection and testing of mortar and grout will be performed by a testing laboratory in accordance with Section 01 45 00. The testing laboratory, in addition to meeting requirements of ASTM E329, must be an approved laboratory competent to perform cement physical testing.
 - 3. Distribution of Results of Tests: Within 24 hours of results of tests, copies of the results shall be submitted to the Architect, Contractor, masonry contractor, and the grout supplier if applicable.
- C. Mortar:
 - 1. Property Specification (ASTM C270): Testing in accordance with ASTM C 780.
 - 2. For determining hardened mortar properties, prepare 3 test specimens for each test age and property. A strength test shall be the average of the strengths of the specimens tested at the age specified. Specimens shall be tested at 7 and 28 days.
- D. Grout:
 - 1. Testing per ASTM C1019.
 - 2. Three test specimens shall constitute one sample. A strength test shall be the average of the strengths of the specimen tested at the age specified.
 - 3. Specimens shall be tested at 7 and 28 days.
 - 4. The compression strength will be considered satisfactory if the average of three consecutive tests of the grout is equal to or greater than the specified strength and no individual strength test falls below the specified strength by more than 500 psi.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Furnishing the following items for installation under Section 04 22 00:
 - 1. Veneer ties and anchors.
 - 2. Control joints.
 - 3. Through wall flashings.
 - 4. Mortar deflection material.
 - 5. Weep holes.
- B. Related Sections:
 - 1. Section 04 22 00 – Concrete Unit Masonry.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's brochures depicting each of the masonry accessories which will be used prior to delivering materials to the site or commencing the Work in this Section.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Store metal items at the site off the ground and in a manner to prevent damage to the materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, subject to compliance with Specification requirements.
 - 1. Dur-O-Wall Inc. www.dur-o-wal.com
 - 2. Heckmann Building Products, Inc. www.heckmannbuildingprods.com
 - 3. Hohmann and Barnard, Inc. www.h-b.com

2.02 MATERIALS

- A. Carbon Steel Sheet: To ASTM A366, hot-dip galvanized after fabrication to ASTM A153, Class B.
- B. Carbon Steel Wire: To ASTM A82, with zinc coating hot-dip galvanized after fabrication to ASTM A153.
 - 1. Tensile Strength: Not less than 80,000 psi.
 - 2. Yield Point: Not less than 70,000 psi.
- C. Reinforcing Steel: As specified in Section 03 20 00.

2.03 ACCESSORIES

- A. General: Anchors and ties shall be steel with zinc coated finish or shall be of other non-corrosive metal.
- B. Adjustable Veneer Anchors
1. Facing over CMU: (Veneer over Air and Vapor Barrier Underlayment over Concrete Unit Masonry Wall Construction): Hohmann & Barnard HB-5213 adjustable veneer anchor with No. 523 Brass Expansion Bolt, or equivalent as approved by the Architect and Structural Engineer from one of the specified Manufacturers.
 - a. Description: Adjustable veneer anchor consisting of an L-shaped 14 gauge ribbed plate section with 7/16 inch hole for connecting 7/16 inch diameter brass expansion bolt, eyelets for hook (pintle) insertion, and 3/16 inch diameter pintle of appropriate length to extend into veneer unit mortar bed a minimum of 1-1/2 inches, with a minimum of 5/8 inch mortar cover at outside face of veneer unit.
 2. Facing over Framing: (Veneer over Air and Vapor Barrier Underlayment over Stud Framing): Hohmann & Barnard HB-213 adjustable veneer anchor, Heckman 315-D with 316, or equivalent as approved by the Architect and Structural Engineer from one of the specified Manufacturers.
 - a. Description: Adjustable veneer anchor consisting of an L-shaped 14 gauge ribbed plate section with 9/32 inch holes for connecting screws, eyelets for hook (pintle) insertion, and 3/16 inch diameter pintle of appropriate length to extend into veneer unit mortar bed a minimum of 1-1/2 inches, with a minimum of 5/8 inch mortar cover at outside face of veneer unit.
- C. Control Joints:
1. Rubber: Extruded, solid section, ASTM D2000 2AA-805 with a durometer hardness of 70 or 80 when tested per ASTM D2240.
 2. Polyvinyl Chloride (PVC): ASTM D2287, Type PVC 654-4 with a durometer hardness of 85 (+5) when tested per ASTM D2240, minimum tensile strength of 1750 psi with minimum 300 percent elongation per ASTM D638, and cold crack brittleness of 50 degrees F per ASTM D746.
 3. Sizes and Profiles: As indicated on Drawings.
- D. Joint Filler: Closed cell neoprene rubber conforming to ASTM D1056, Grade 2A1, oversized 50 percent, self expanding, 2-3/4 or 3 inch width by maximum length.
- E. Self-adhering Composite Flashing: Self-adhering composite flashing product composed of a high-density, cross-laminated polyethylene film coated on one side with a layer of pliable, adhesive rubberized-asphalt compound.
1. Overall Thickness: Not less than 0.040 inch.
 2. Acceptable Manufacturers and Products:
 - a. CCW-705-TWF Thru-Wall Flashing, Carlisle Coating and Waterproofing www.carlisle-ccw.com
 - b. Perm-A-Barrier Wall Flashing, W.R. Grace & Co. www.graceconstruction.com
 - c. Polyguard 300 Thru Wall Flashing Membrane, Polyguard Products, Inc. www.polyguardproducts.com
 - d. Blueskin TWF, Henry Company www.henry.com
 - e. Equivalent as approved by Architect.
 3. Primer: Provided by the flashing manufacturer. Must be applied to all glass-matt faced exterior gypsum sheathing unless specifically allowed otherwise by manufacturer in writing specific to this project.

- F. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard. Acceptable products include the following:
 - 1. Mortar Net USA, Ltd.; Mortar Net Weep Vents.

- G. Mortar Deflection Material: Polymer based geomaterial made of high density polyethylene strands woven into a 90 percent open mesh weave design. Acceptable products include the following:
 - 1. Mortar Web, Sandell Construction Solutions www.sandellmfg.com
 - 2. Mortar Maze, Advanced Building Products, Inc. www.advancedbuildingproducts.com
 - 3. Mortar Net, Mortar Net USA, Ltd. www.mortarnet.com

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Installation of masonry accessories shall be as specified under the following Section and in accordance with AMG Standard 108.
 - 1. Section 04 22 00 – Concrete Unit Masonry.

- B. Control Joints: Provide control joints as indicated on Drawings and in accordance with the requirements of Specification Section for the masonry units.

- C. Through Wall Flashing:
 - 1. Provide through-wall flashings as indicated on Drawings and in accordance with the requirements of Specification Section for the masonry units.
 - 2. Specified flashing and accessories are not designed for use as a finished surface or for use in areas where they will be exposed to sunlight. Prevent contact with products containing fresh coal tar or coal tar pitch. Prevent contact with sealant products containing polysulfide polymers due to incompatibility.
 - 3. Remove deleterious materials from surfaces to be flashed.
 - 4. Apply surface conditioner by spray, brush or roller at the rate recommended by manufacturer to dirty or dusty surfaces or surfaces having an irregular or rough texture before installing flashing membrane.
 - 5. Remove silicone-coated release paper and position flashing carefully before placing it against the surface. When properly positioned, place against surface by pressing firmly into place by hand roller or blunt object, such as the backside of a utility knife. Fully adhere flashing to substrate to prevent water from migrating under flashing.
 - 6. Overlap adjacent pieces 2 inches and roll overlaps with a steel hand roller or a blunt object. Fully seal overlaps to prevent water leakage through laps. Trim bottom edge 1/2 inch back from exposed face of the building.
 - 7. At heads and sill where flashing is indicated to be placed, turn up ends a minimum of 2 inches and make careful folds to form a pan, with the pan seams sealed with compatible mastic acceptable to flashing manufacturer.
 - 8. Apply a bead or trowel coat of compatible mastic acceptable to flashing manufacturer along top edge, seams, cuts and penetrations. Seal penetrations through flashing with compatible mastic acceptable to flashing manufacturer.

- D. Weep Holes: Provide weep holes as indicated on Drawings and in accordance with the requirements of Specification Section for the masonry units.

- E. Mortar Deflection Material: After the first one or two courses of brick have been set, clean cavity of any miscellaneous mortar or debris and place mortar deflection material in the cavity of the wall on top of installed flashing.

3.02 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 04 05 26

CMU INTEGRAL WATER REPELLENT

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Performance Requirements: Water repellent admixture shall be provided in both the masonry units and mortar used in all exterior exposed CMU wall construction, and shall constitute a complete integral water repellent system for exterior above grade walls meeting the following requirements:
1. Admixture shall leave the finished surfaces water repellent and shall not alter the natural texture or color of the masonry units.
 2. Admixture shall provide wind driven rain resistance equivalent to Class E Rating as measured by ASTM E514-74.
 3. Bond strength as determined by ASTM E72 shall not be reduced by the use of the water repellent admixture.

1.02 QUALITY ASSURANCE

- A. Qualifications:
1. Water Repellent Manufacturer: Engaged in producing materials with a satisfactory performance record for at least 5 years.
 2. Masonry Unit Fabricator/Manufacturer: Trained, approved and accepted by the manufacturer.
- B. Regulatory Requirements: Use of water repellent admixtures shall be in strict accordance with applicable Federal, State and local requirements, including, but not limited to, environmental regulations.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Mortar admixture shall be delivered to the job site in manufacturer's original unopened containers and packaging, with labels clearly identifying product name, manufacturer, and batch number.
- B. Store admixture in clean, dry area indoors in accordance with manufacturer's instructions; keep containers sealed until ready for use, keep from freezing, do not use admixture once frozen.
- C. Protect admixture during handling to prevent damage or contamination.

1.04 WARRANTY

- A. Water Repellent Manufacturer: Water-repellent shall be warranted by Admixture manufacturer to be free of defects and to meet manufacturer's published physical and chemical properties.
- B. CMU producer shall warrant that Integral Polymeric CMU Water-repellent has been provided at appropriate dosage rate in all units shipped to this project for use in exterior walls.

- C. Masonry Installer shall warrant that only CMUs and mortar containing Integral Polymeric CMU Water-repellent have been placed in exterior walls and that admixture was included in the mortar mix in accordance with water repellent manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Water-Repellent Admixture: The following shall be included in exterior masonry units.
 - 1. Liquid polymeric admixture(s) formulated for mixing with mortar mix and formulated for mixing with concrete during production of concrete masonry units to cross link and provide resistance to water penetration to achieve a Class E Rating when tested in accordance with ASTM E514.
 - 2. Admixture shall not reduce flexural and compressive strength of mortar when tested in accordance with ASTM C1072 and C780.
 - 3. Concrete Masonry Unit Manufacturer: Acceptable to integral water repellent manufacturer and qualified by integral water repellent manufacturer to comply with ASTM E514 for water permeance testing.
 - 4. Acceptable Products include the following:
 - a. Dry Block Mortar Admixture as manufactured by W.R. Grace & Co. - Conn., Cambridge, MA (800) 558-7066. www.grace.com
 - b. Eucon Blocktite Mortar Admixture as manufactured by The Euclid Chemical Company, Cleveland, Ohio (800) 321-7628 www.euclidchemical.com
 - c. RainBloc admixture as manufactured by ACM Chemistries, Inc. www.acmchem.com

PART 3 EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION

- A. In accordance with Sections 04 05 15 and 04 22 00 and manufacturers recommendations.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes concrete masonry units including setting materials and accessories.
- B. Related Sections:
 - 1. Section 04 05 23 – Masonry Accessories, for control joints, wall ties, through-wall flashings, weep holes, mortar deflection material, and cavity vents.

1.02 SUBMITTALS

- A. Samples: Submit samples to Architect for review prior to delivering materials to Site or commencing Work in this Section.
 - 1. Provide 2 samples of each type and weight classification of concrete masonry units, (stretcher units), to be used on Project showing range of texture and/or color variations of exposed surfaces for units.
 - 2. Units provided to Project shall match these samples.
- B. Shop Drawings: Submit Shop Drawings showing proposed location of control joints and obtain approval of same from Architect and Structural Engineer prior to construction.
- C. Certificates: Submit certification to the Architect prior to delivery of concrete masonry units to jobsite, signed by Concrete Masonry Unit Manufacturer, stating that the concrete masonry units to be supplied: 1) shall meet the specified requirements for concrete masonry units for exterior building wall construction, and; 2) are suitable for proposed usage.
- D. Test Reports:
 - 1. Submit test results for concrete masonry units for exterior building wall construction to be used to Architect in accordance with Section 01 45 00.
 - 2. Test results shall clearly indicate:
 - a. Types of materials and composition, including integral water repellent.
 - b. Classification of concrete masonry unit in accordance with ASTM C90 requirements.
 - c. Water penetration and leakage in accordance with testing specified under Source Quality Control specified in this section.
 - 3. Testing laboratory shall notify Architect of non-conforming material submittals.

1.03 QUALITY ASSURANCE

- A. Standards:
 - 1. The "Levels of Quality", Standard 107 of Arizona Masonry Guild (AMG) shall apply and by reference is hereby made a part of this Specification. Reference to Custom, Standard or Economy in this Specification shall be as defined in latest edition of AMG Standard 107.
 - 2. Comply with the requirements of ACI 530.1/ASCE 6 "Specifications for Masonry Structures", except as otherwise indicated.
- B. Regulatory Requirements: Masonry materials and workmanship shall meet requirements of building codes which are applicable to jurisdiction in which Project is located.

- C. Certifications: Concrete masonry units shall be supplied by a manufacturer participating in the Certified Block Program of the Arizona Masonry Guild.
- D. Installer Qualifications: The Masonry Subcontractor shall have a supervisor on the jobsite, whenever masonry work is being performed, who is Certified by the Arizona Masonry Contractors Association. Proof of certification shall be submitted to the Architect prior to start of masonry work.
- E. Mock-Ups: Prior to start of Work, construct a sample panel from approved materials, containing each different kind or color of concrete masonry units, approximately 4 feet high x 6 feet long or as required to illustrate wall design under direction of Architect.
 - 1. Sample wall shall provide a standard of workmanship, bond, thickness and tooling of joints.
 - 2. Construct successive sample panels until standard is approved.
 - 3. When accepted, sample wall shall be standard of comparison for remainder of masonry Work.
 - 4. This sample, when accepted by the Architect, will function as a reference base for acceptance or rejection of final work.
 - 5. Sample wall shall be reviewed by the specification writer or Architect's contract administrator for acceptance.
 - 6. Sample wall shall receive water repellent as specified in Section 07 19 00.
 - 7. Upon completion of Project, remove sample wall from site and dispose of in a legal manner.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Transport and handle masonry units in such a manner as to prevent chipping and breakage.
- B. Deliver and store materials in dry, protected areas.
- C. Keep free of stain or other damage.
- D. Locate storage piles, pallets, stacks or bins to avoid or protect material from heavy or unnecessary traffic.
- E. Segregate storage piles, pallets, stacks or bins of fire-rated units from non-rated units and maintain clear identification of the rating of the units.
- F. Replace damaged material at no cost to Owner.

1.05 PROJECT/SITE CONDITIONS

- A. Hot Weather Requirements:
 - 1. When ambient air temperature exceeds 100 degrees F., or when ambient air temperature exceeds 90 degrees F. and wind velocity is greater than 8 mph, Masonry Contractor shall implement hot weather protection procedures as submitted to Architect.
 - 2. Do not spread mortar beds more than 4 feet ahead of placing block units.
 - 3. Place block units within one minute of spreading mortar.

- B. Cold Weather Requirements:
 - 1. Fully protect concrete masonry units against freezing by a weather-tight covering which shall also prevent accumulation of ice.
 - 2. Do not lay concrete masonry units when temperature of surrounding atmosphere is below 40 degrees F. or is likely to fall below 40 degrees F. in the 24 hour period after laying, unless adequate protection is provided.

1.06 SCHEDULING AND SEQUENCING

- A. Coordination: Coordinate with other Trades whose Work relates to concrete masonry unit installation for placing required blocking, backing, furring, conduits and other items.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General Requirements for Concrete Masonry Units:
 - 1. Concrete masonry units shall meet ASTM C90 requirements except that when CMU will be exposed in final construction, ASTM C90-00, paragraph 7.2.1 shall be modified to read: "Three percent of a shipment containing chips not larger than 1/2 inch in any dimension, or cracks not wider than 0.02 in. and not longer than 10 percent of the nominal height of the unit is permitted." Linear shrinkage of units of units shall not exceed 0.065 percent.
 - 2. Units shall be in the same condition in wall as they were upon delivery.
 - 3. Unit sizes shall be 8 by 8 by 16 inches, 8 by 4 by 16 inches, and 4 by 4 by 16 inches (veneer units), and other sizes as may be indicated on Drawings.
 - 4. Texture and color shall be consistent for all units provided for exposed walls. Range of texture and color shall be within that shown by samples reviewed by Architect.
 - 5. Surface of units shall be clean and free from dirt when laid in walls.
 - 6. Units not complying with the appropriate ASTM Standards and AMG Standard 107 shall not be laid in the wall where exposed to view. Any unit that is chipped in excess of the requirements of AMG Standard 107 will be rejected and shall be removed and replaced.
 - 7. Provide special block sizes and shapes required or as shown on Drawings.
 - 8. CMU may be used for construction of building walls exposed to the exterior if they comply with requirements specified under Source Quality Control.
 - 9. Water-Repellent Admixture: In accordance with Section 04 05 26. Concrete masonry units used to construct exterior building walls shall contain the recommended amount of integral water repellent admixture, as per manufacturer's certification program.
- B. Hollow CMU Classifications: The following requirements shall apply to all shapes, colors, textures and sizes of CMU provided.
 - 1. Medium weight units: Weighing 105 lbs. per cubic foot to less than 125 lbs. per cubic foot and manufactured from a combination of volcanic scoria aggregate conforming to ASTM C331 and sand conforming to ASTM C33.
 - 2. Normal weight units: Weighing 125 lbs. per cubic foot or more and manufactured with sand conforming to ASTM C33.
 - 3. Fire-resistant Rated Lightweight Units: Provide units manufactured and certified to comply with UL 618 – Standards of Concrete Masonry Units for the fire-resistance rating required.
 - a. Weighing less than 105 lbs per cubic foot and manufactured with sand and gravel, cinders, blast furnace slag, expanded clay or shale, pumice, or other proprietary aggregates complying with ASTM C331

- C. Standard Smooth Faced CMU: Manufacturer's standard smooth faced units, except where indicated to be integrally colored.
 - 1. Integral Color Units: As scheduled on Drawings.
- D. Accessory Units: Provide units as required for window sills and jambs, doors, control joints, bond beams, lintels, pilaster, caps and other locations as indicated on Drawings with a minimum of block cutting. Accessory units shall match adjacent unit color and texture unless noted otherwise.

2.02 ACCESSORIES

- A. Joint Reinforcing: Joint reinforcing in accordance with requirements of IBC 2012, Chapter 21.
- B. Reinforcing Steel: As specified under Section 03 20 00.
- C. Control Joints: As specified under Section 04 05 23.
- D. Wall Ties, Through-Wall Flashings, Weep Holes, Cavity Vents: As specified in Section 04 05 23.
- E. Mortar and Grout: As specified under Section 04 05 15. Provide water-repellent admixture in accordance with Section 04 05 26.
- F. Sheet Metal Flashings: See Section 07 60 00. Furnish shapes in accordance with project requirements and NCMA TEK 19-2A, 19-4A and 19-5A.
- G. Steel Lintels: As indicated or scheduled on Structural Drawings.

2.03 SOURCE QUALITY CONTROL

- A. Concrete masonry units to be provided for exterior exposed building wall construction shall be tested by manufacturer using a spray bar test as follows:
 - 1. Testing shall be performed at no additional cost to Owner.
 - 2. Individual concrete masonry units shall be placed on a rack where water is sprayed at a rate of 140 gallons per hour for a minimum of 4 hours.
 - 3. Testing shall be made upon concrete masonry units prior to application of post-applied water repellent.
 - 4. Test results for units regularly manufactured using a standard mix design within the previous 6 months shall be acceptable.
 - 5. Test results shall meet or exceed the following:

Location	Results
Inside front face shell	<20% damp (no running water or sheen)
Center web	Dry
Inside outer web	<10% damp
Inside of back face shell	Dry
Outside of back face shell	Dry

- 6. Submit test reports as specified herein under "Submittals."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installer shall examine supporting structure and conditions under which unit masonry is to be installed, and notify Contractor, in writing, conditions detrimental to proper and timely completion of Work. Do not proceed with the installation of unit masonry Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- B. Do not use units with chips, cracks, or other defects which might be visible in the finished Work unless otherwise acceptable to the Architect.
- C. Do not build on frozen Work; remove and replace unit masonry Work damaged by frost or freezing.
- D. Do not use frozen materials or materials mixed or coated with ice or frost. Do not lower freezing point of mortar by use of admixtures or anti-freeze agents, and do not use calcium chloride in mortar or grout.

3.02 PREPARATION

- A. Protection: Protect sills, ledges, offsets and other projections from dropping of mortar and grout.

3.03 ERECTION, INSTALLATION, APPLICATION

- A. General Requirements for Concrete Masonry Walls:
 - 1. Workmanship:
 - a. Provide Standard Level workmanship as defined by AMG Standard 107.
 - b. Concrete masonry units which will be exposed in the finished work shall be treated as an architectural finish and shall be handled carefully to ensure that chippages do not occur during handling and laying. Handling shall be minimized on the jobsite to eliminate chances for chippage.
 - 2. Lay units in uniform and true courses, level and plumb to height indicated on Drawings.
 - 3. Lay concrete unit masonry in such a way that cracks are not formed at time unit is placed in wall.
 - 4. Units shall not be wetted before being used and shall be laid dry.
 - 5. Adjusting Units:
 - a. Units shall be adjusted to be level, plumb and straightened into final position in wall while mortar is still soft and plastic enough to ensure a good bond.
 - b. Avoid over-plumbing and pounding of corners and jambs to fit stretcher units after they are set in position.
 - c. If position of unit is shifted after mortar has stiffened, or bond is broken or cracks are formed, re-lay unit in new mortar.
 - 6. Bearings on Walls: Provide 3 courses of solid units or grouted hollow masonry units below steel bearing plates or beams bearing on walls. Extend bearings each side of contact with load as required to properly transfer loads into wall.
 - 7. Openings: Provide openings in masonry walls where required or indicated. Steel lintels shall be provided unless otherwise noted.
 - 8. Flashings: Surface of masonry shall be smooth and free from projections which will puncture flashing materials. All sheet metal flashings shall have hemmed edges.

9. Weep Holes: If required, shall be provided in the head joints of the first course and be at a maximum of 24 inches on center.
 10. Mortar Deflection Material: Place mortar deflection geomaterial in wall cavity after one or two CMU veneer courses have been set on top of the flashing and installed weep holes in accordance with 04 05 23.
 11. Cutting of masonry: When required, exposed block units shall be cut with a power driven Carborundum or diamond disc blade saw. When using "wet" cutting methods, clean water shall be used on exposed units.
 12. Where fresh masonry joins masonry that is partially or totally set, the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond with the new Work. Loose brick and mortar shall be removed.
 13. If it becomes necessary for construction purposes to "stop-off" a horizontal run of masonry, this shall be done by racking back on half a CMU veneer unit length in each course and , if grout is used, stopping the grout 4 inches back of the rack. Tothing will not be permitted, except upon written approval of the Architect.
- B. Anchorage of CMU Veneer to:
1. Masonry and ICF:
 - a. Provide ties anchored into masonry backup construction.
 - b. Anchors shall be spaced so as to support not more than 2 square feet of wall area, but not more than 24 inches o.c. horizontally, unless noted otherwise on drawings.
 - c. Maintain a space not less than one inch in width between masonry walls, keeping space free of mortar or other rigid materials.
 2. Framed Walls:
 - a. Anchor veneer with adjustable ties or anchors spaced so as to support not less than 2 square feet of wall area, but not more than 16 inches vertically and 24 inches horizontally with additional ties within 12 inches of openings and spaced not more than 12 inches around perimeter of openings.
 - 1) Locate anchor section relative to course where tie section is embedded to allow maximum vertical differential movement of tie up and down.
 - b. Fasten ties through sheathing to wall framing with two corrosion resistant coated screws.
- C. Bonding:
1. Bond pattern shall be regular running bond unless indicated otherwise on the drawings.
 2. Bond shall be plumb throughout face of wall.
 3. No pieces shorter than 4 inches shall be used at corners or jambs.
- D. Bearing Wall Intersections:
1. Intersecting block bearing walls shall not be tied together in a masonry bond, except at corners.
 2. One wall shall terminate at face of other wall with a control joint at intersection.
 3. Tie intersecting wall together with a metal tie bar, 1/4 inch x 1-1/4 inches x 2'-4" long with a 2 inch right angle bend at each end of bar, spaced vertically at 2 feet on center.
 4. Bends at ends of tie bars shall be embedded in grouted cells.
 5. Rake out vertical joint between intersecting walls to a depth of 3/4 inch after mortar has stiffened.
 6. Provide sealing of control joint as specified in Section 07 92 00.

- E. Non-Bearing Wall Intersections:
1. Tie non-bearing wall together with strips of metal lath or galvanized 1/4 inch mesh hardware cloth placed across joint between 2 walls placed in alternate horizontal block courses.
 2. Rake out vertical joint between intersecting walls to a depth of 3/4 inch after mortar has stiffened.
 3. Provide sealing of control joint as specified in Section 07 92 00.
- F. Joining of Work:
1. Where fresh masonry joins partially set masonry the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond.
 2. Remove loose concrete block and mortar.
 3. Stop-off a horizontal run of masonry by racking back 1/2 brick length in each course and, if grout is used, stopping the grout 4 inches back of the rack.
 4. Tothing will not be permitted, except upon written approval of the Architect.
- G. Mortar Joints:
1. Joints shall be straight, clean and a uniform 3/8 inch thickness on exposed wall face and in accordance with NCMA TEK 19-2A.
 2. Exposed vertical and horizontal joints shall be tooled when mortar is “thumbprint” hard with round or other approved jointer, slightly larger than the width of the joints to produce a dense, slightly concave tooled surface which is well bonded to block at edges.
 3. Joints shall be tooled flush at:
 - a. Below grade and planter surfaces to receive waterproofing.
 - b. Interior or exterior surfaces to receive ceramic tile, metal wall panels, furred wall construction, or other finishes requiring flush joints that are to be concealed.
 4. Solidly fill joints from face of unit to depth of face shell, except where specified otherwise.
 5. Full bedding to be provided for first course on foundation and wherever maximum strength is required.
 6. Butter vertical head joints well and shove these joints tight so that mortar bonds well to both units.
 7. Full coverage to be provided on bed of face shells and webs surrounding cells to be filled.
 8. Bee-holes or other open joints shall be filled and tooled with mortar while mortar is still fresh.
- H. Control Joints:
1. Provide control joints, as detailed, at vertical masonry walls where such walls exceed 40 feet in length. In long length of walls, provide joints at approximately 24 feet on center or as detailed.
 2. Control joints shall be continuous full height of walls.
 3. At bond beams, control joints shall separate both block and grout; however, steel reinforcing shall be continuous.
 4. Horizontal wire reinforcing shall not run through control joint.
 5. Control joints shall not occur at wall corners, intersections, ends, within 24 inches of concentrated points of bearing or jambs or over openings unless specifically indicated on Structural Drawings.
 6. Control joint materials shall be held back from finished surface as required to allow for sealant and back-up materials.

- I. Horizontal Joint Reinforcing:
 - 1. Place horizontal joint reinforcing every 16 inches vertically throughout wall construction.
 - 2. Continuously reinforce first bed joint immediately above and below openings. Provide reinforcing in second bed joint above and below openings which extends 2 feet beyond each side of opening.
 - 3. Lap splices in reinforcing in accordance with Structural Drawings.
 - 4. Cut and bend reinforcing at corners.

- J. Vertical Reinforcing and Bond Beam Reinforcing:
 - 1. Place in accordance with requirements of Drawings.
 - 2. Vertical Reinforcement: Provide continuous reinforcing full height of wall at wall ends, corners, intersections, jambs of openings and each side of control joints. Vertical reinforcing shall match and lap dowels which are at top of foundation walls and precast concrete beams.
 - 3. Bond Beams: Provide horizontal reinforcing of 2 bars in minimum 8 inch deep grouted continuous bond beam at roof and elevated floor lines.
 - 4. Parapets: Provide horizontal reinforcing of 1 bar in minimum 8 inch deep grouted continuous bond beam at top of parapets.
 - 5. Bond Beam and Parapet Reinforcing at Vertical Control Joints: Place bars continuous through control joint and wrap mastic tape around bars for 18 inches each side of control joint.
 - 6. Bond Beam and Parapet Reinforcing at Corners and Wall Intersections: Provide bent bars to match reinforcing at corners and wall intersections.
 - 7. Lap splices in reinforcing in accordance with Structural Drawings.
 - 8. Use spacers to position reinforcing steel in center of grout at center of wall as required by code.

- K. Grouting:
 - 1. Reinforcing steel is to be in place and inspected before grouting starts.
 - 2. Vertical cells to be filled shall have vertical alignment to maintain a continuous cell area.
 - 3. Keep cell to be grouted free from mortar.
 - 4. Fill cells solidly with grout in lifts not to exceed 5 feet.
 - 5. Grout may be poured by hand bucket, concrete hopper or through a grout pump.
 - 6. Do not wet down grout space prior to pouring of grout.
 - 7. Stop pours 1-1/2 inches below top of cell to form a key at pour points.
 - 8. Grout shall be consolidated by mechanical vibration during placing before loss of plasticity in a manner to fill grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated, or rodded.
 - 9. Grout barrier below bond beams shall be continuous wire lath or other approved material.
 - 10. Grout beams over openings and bond beams in a continuous operation.
 - 11. Solidly grout in place bolts, anchors and other items within wall construction.
 - 12. Fully grout jambs and head of metal door frames connected to masonry. Filling of frames shall be done as each 2 feet of masonry is laid.
 - 13. Use extreme care to prevent grout or mortar from staining face of the masonry.
 - 14. Immediately remove grout or mortar which is visible on face of masonry.

- L. Provisions for Other Trades and Built-in Items:
 - 1. Build in items required and indicated, including; but not limited to, reinforcing steel, anchors, flashings, sleeves, frames, structural steel, loose lintels, anchor bolts, nailing blocks, door and window frames and miscellaneous iron.

2. Enclosures for pipes, stacks, ducts and conduits:
 - a. Construct slots, chases, cavities, and similar spaces as required.
 - b. Where masonry is to enclose conduit or piping, bring it to proper level indicated and as directed.
 - c. Cover no pipe, conduit chases or enclosures until advised that Work has been inspected and approved.

M. Tolerances; Standard Level of Quality: In accordance with AMG Standard 107.

N. Joint and Crack Control: In accordance with NCMA TEK 10-1.

O. Flashing: In accordance with NCMA TEK 19-2A, 19-4A and 19-5A and 19-4, and as detailed on Drawings.

P. Weep holes shall be provided above lintels and vertical obstructions as per manufacturer's flashing and weep hole diagrams, and as detailed on Drawings.

3.04 FIELD QUALITY CONTROL

- A. Masonry Tests: Inspection and testing of masonry will be performed by a testing laboratory in accordance with Section 01 45 00.
 1. Provide free access to Work and cooperate with appointed firm.
 2. Water testing of CMU exterior building walls shall be provided as specified in Section 07 19 00.

3.05 ADJUSTING

- A. Pointing of Mortar Joints:
 1. Point and fill holes and cracks in exposed mortar joints.
 2. Cut out defective mortar joints to a depth of at least 1/4 inch.
 3. When cutting is complete, remove dust and loose material by brushing or vacuuming.
 4. Prehydrate mortar for pointing by mixing dry ingredients with only sufficient water to produce a damp mass of such consistency that it will retain its form when it is pressed into a ball with hands, but will not flow under trowel.
 5. Allow mortar to stand for a period of not less than one hour nor more than 2 hours, after which remix with addition of sufficient water to produce satisfactory workability.
 6. Pointing mortars shall be identical to adjacent mortar in similar joints and finish results shall match and be indistinguishable from original mortar used.
 7. Premoisten joint and apply mortar tightly.
 8. Tool to match adjacent joints.
 9. Moist cure for 72 hours.
- B. Patching: If approved by Architect, patching of exposed masonry walls shall be done at conclusion of general Work and shall conform as closely as possible to similar surrounding or adjoining Work.

3.06 CLEANING

- A. Daily Cleaning: Keep walls clean. Soiled masonry from mortar and grout spills which will be exposed to view at completion of Project shall be cleaned immediately with stiff fiber brushes until wall is free of dropped or spattered mortar.

- B. Walls indicated to be painted shall be cleaned with stiff fiber brushes until wall is free of all surface free of all dropped and splattered mortar and irregular surfaces that would telegraph through the painted finish or interfere with paint adhesion.
- C. Clean walls to be exposed in the finished work in accordance with Section 04 01 20.52. Do not clean walls by sand blasting.
- D. Remove scaffolding and equipment used in Work.
- E. Clean up debris, refuse and surplus material and remove from premises.

3.07 PROTECTION

- A. Furnish temporary protection for exposed masonry corners subject to injury.
- B. Carefully cover tops of walls left incomplete at conclusion of day's Work with tarpaulins or other approved covering.
- C. In hot and dry weather, protect masonry against too rapid drying.
- D. Protect finished Work against freezing for a period of not less than 48 hours by means of enclosures, artificial heat, or such other protective methods as may be required.

END OF SECTION

SECTION 05 10 00

STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Structural steel framing including, but not limited to:
 - 1. Columns
 - 2. Beams
 - 3. Steel tube and plate framed custom structural steel trusses.
 - 4. Ledgers and Lintels
 - 5. Anchor Bolts
 - 6. Bearing Plates
 - 7. Other Miscellaneous Structural Steel Items.
- B. Related Sections:
 - 1. Section 05 50 00 – Metal Fabrications, for miscellaneous metal fabrications and other non-structural steel fabrications.

1.02 SUBMITTALS

- A. Shop Drawings: Submit shop and erection Drawings clearly showing each piece required for fabrication and erection. Drawings shall include material grade, camber, holes and other pertinent data. Indicate welds by standard AWS symbols showing size, length, and type of each weld.
- B. Test Reports: Submit reports for welded connection tests.
- C. Submit anchor setting drawings clearly showing location of all anchor bolts and embedded plates to be anchored in concrete and masonry construction. Provide templates for anchor bolts.

1.03 QUALITY ASSURANCE

- A. Welding:
 - 1. Performed by certified welders in compliance with AWS D.1 Structural Welding Code.
 - 2. Welders shall be duly qualified within the last 12 months in the position in which they are to weld and the qualifications and Specifications for workmanship shall comply with the AWS requirements "AWS Structural Welding Code - Steel."
- B. Certifications:
 - 1. Prior to fabrication or shipment of material to the job site, furnish certification of the Manufacturer of the structural steel that material furnished meets or exceeds requirements of ASTM standards specified or noted on Drawings, for each type of material.
 - 2. Prior to site welding operation, submit welders' written certifications and qualifications, including date of each welder's certification performing work on the Project.
- C. Tolerances: All steel exposed to view shall be architectural steel, and tolerances as a minimum shall comply with section 10 of AISC code of standard practice.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.
- B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Materials shall be new, of uniform quality, suitable and without defects affecting the strength or service of the structure.
- B. Structural Steel:
 - 1. Wide Flange: ASTM A992 (Fy = 50 ksi), unless otherwise indicated.
 - 2. Other Rolled Shapes Including Channels, Angles, Plates, Bars and Rods: ASTM A36 (Fy = 36ksi), unless otherwise indicated.
 - 3. All structural rolled members with Fy greater than 36 ksi shall be identified with an ASTM specification mark or tag in accordance with IBC Section 2203.1.
- C. Square or Rectangular HSS: ASTM A500, Grade B (Fy = 46 ksi).
- D. Steel Pipe: ASTM A53, Type E or S, Grade B (Fy = 35 ksi).
- E. High Strength Bolts: ASTM A325N TC, unless noted otherwise.
- F. Anchors and Anchor Bolts: ASTM F1554 Grade 36 (A307).
- G. Welded Anchors and Shear Connectors: ICC approved, as manufactured by KSM or Nelson. Substitutions must have ICC approval and be of equivalent capacity for the intended use.
- H. Welding Rods: AWS A5.0, E70 series, low hydrogen type.
- I. Metal Primer: VOC compliant.
 - 1. Interior Steel (where indicated to be painted): Tnemec 88HS-0559 Gray www.tnemec.com, modified short oil alkyd; or Tnemec 10-99 modified alkyd, chemically active, rust-inhibitive primer, or equivalent as standard with fabricator.
 - 2. Exterior Steel: Provide primer specified in Section 09 91 00 – Painting, for exposed structural steel indicated to receive High Performance Paint System.
- J. Grouts: As specified in Section 03 30 00.

2.02 FABRICATION

- A. Workmanship and details of construction (except as otherwise indicated or specified) shall be in conformity with applicable articles of the latest AISC Manual, Parts 1 through 4; AISC Specifications; except Section A7 (Design Documents) and Chapter N (Plastic Design); and the applicable building codes. Sections 3.1, 3.4 and 4.2 of AISC code of Standard Practice are specifically excluded from this work.
 - 1. Sections shall be of dimensions, weight and design as indicated, assembled complete at the shop, with base plates and other detailed materials attached.
 - 2. Furnish shims at columns where base plates are shop fabricated to columns.

3. Make connections as indicated or detailed, on the Drawings and the reviewed shop and erection Drawings.
 4. Exposed steel shall have smooth, clean surfaces with no identifying trade marks, names etc., exposed to view.
 5. Leave in condition for finish painting.
- B. Bolted connections shall be as detailed or shall conform to AISC standard bolted connections with maximum number of 3/4-inch diameter bolts. See Framed Beam Connections Tables II, III, or IV of AISC Manual of Steel Construction.
- C. Where bolt holes in steel members are enlarged to more than 1/16 inch diameter oversize, provide 3/16 inch x 2-1/2 inch x 2-1/2 inch plate washers to steel members with 3/16 inch fillet weld all around.
- D. Loose Steel Lintels: Provide loose structural steel shape lintels for openings and recesses in masonry walls and partitions, as shown. Weld adjoining members together to form a single unit. Provide not less than 4 inch bearing at each side of openings, unless otherwise shown.
- E. Shelf Angles: Provide structural steel shelf angles of sizes shown for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise shown.
- F. Loose Bearing Plates: Provide loose bearing 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.

2.03 SHOP FABRICATION FOR USE OF HIGH STRENGTH BOLTS

- A. Joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of loose mill scale, burrs, or any foreign material (including paint). Field paint these areas with the specific shop paint after erection and completion.
- B. Joints using high strength bolts shall be inspected by a representative of an independent testing laboratory acceptable to the Owner's Representative.
1. Inspection shall be accomplished by the use of a properly calibrated torque wrench.
 2. Calibration shall be by the procedure specified in the Specifications for structural joints using ASTM A325 or A490 bolts, under Section 9, inspections (pp. 6.2-53) Thirteenth Edition, AISC Manual of Steel Construction.
 3. Check a minimum of 20 percent of the bolts in each connection.
 4. If one or more of the bolts checked in any connection is below the minimum tension, check all of the bolts in that connection.
 5. Bolts which cannot be properly tensioned will be rejected.
- C. Check calibrated wrenches individually for accuracy at least once daily for actual conditions of application.
- D. All high strength bolts shall be installed as bearing type connections with threads included in the shear plane, unless noted otherwise on the Structural Drawings. Submit copies of the torque reading for each connection directly to the Architect in the form of a report, along with the minimum torque values required to reach the specified tensions and the calibration procedures.
- E. The use of load indicator washers or twist-off spline type of fastener requires specific prior approval of the Architect.

2.04 SHOP WELDING

- A. Make welds by the electric-arc process.
- B. Grind exposed welds smooth.
- C. Where weld size is not indicated, it shall develop full strength of member and connection.

2.05 PAINTING - SHOP COAT

- A. Shop prime all structural steel, except as follows:
 - 1. Steel that is not exposed to weather shall not be painted.
 - 2. Items of steel and iron Work indicated or specified to be encased in concrete. Partially embedded steel shall have primer applied to area embedded in concrete to a depth of 2 inches.
 - 3. Surfaces to be welded.
 - 4. Surfaces to be high-strength bolted with slip-critical connections.
- B. Clean steel Work by wire brushing, or by other means selected by the fabricator, of loose mill scale, loose rust, accessible weld slag, or flux deposit, dirt and other matter before shop coat of paint is applied. Clean in accordance with SSPC SP-6 as required. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
- C. After cleaning, give steel Work one coat of metal primer. Apply primer thoroughly and evenly to dry surfaces by brush, spray, roller coating, flow coating or dipping at the selection of the fabricator.
- D. Apply primer to provide a wet film of 2.0 mils.
- E. Paint erection marks on painted surfaces. Touch-up surfaces where welding, grinding of welds, joints, etc. are done in the field.
- F. The paint shall be thoroughly dry before the members are handled or loaded.
- G. Comply with Section 09 91 00 for application of high performance paint system primer applied to exposed exterior steel indicated to receive high performance paint system.

2.06 SOURCE QUALITY CONTROL

- A. Tests: Where a welded splice is fabricated in beams or columns other than those detailed, fabricator shall have splice connection tested using one of the following methods: magnetic particle, radiographic, or ultrasonic. Testing shall be conducted by an independent testing laboratory and a report submitted to the Architect. The costs of this testing shall be borne by the fabricator.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify anchor bolt locations, grouting and elevation of base and setting plates, and other material set by other Trades before commencing Work.

2. Notify Architect of Work set by others which does not comply with specified tolerances. Do not erect material upon such Work until it has been satisfactorily corrected.
3. Start of Work implies acceptance of Work of other Trades affecting structural frame erection.

3.02 ERECTION

- A. Erect Work to the proper lines and levels, plumb and true, and in correct relation to other Work maintain this condition to completion.
- B. Connections:
 1. Machine Bolting:
 - a. Fair-up holes with pins to align holes before bolting.
 - b. Ream unfair holes to obtain alignment or drill new holes.
 - c. Enlargement of holes with drift pins or burning of new holes is not permitted.
 - d. Draw bolts up tight after members are aligned and leveled, and set or deform threads to prevent loosening.
 - e. All high strength bolts shall be installed as bearing type connections with threads included in the shear plane.
 2. Welding:
 - a. Welds shall be per AWS standards and procedures.
 - b. Submit certification that welders have passed AWS code qualification tests.
 - c. Refer to Shop Drawings for weld size and dimensions.
 - d. Close joints exposed to weathering with continuous 1/8 inch weather welds.
 - e. Grind smooth exposed welds, but grinding shall not reduce weld strength or required cross section.
 - f. Protect finish material from damage due to welding.
 - g. Remove unsatisfactory welds by chipping or arc air method.
 3. Connect members temporarily and align completely before making permanent connections.
 - a. Temporary conditions shall consist of bolts in no less than 1/3 of the holes and in no case less than 3 bolts in any single connection.
 - b. Surfaces in contact shall be thoroughly clean when assembled.
 - c. Provide necessary temporary bracing and guying to align the structure properly for permanent connections, and safely resist erection, dead load and wind stress.
 - d. Take particular care to have the Work plumb and level (maximum slope ratio tolerance 1 to 500 for interior members, 0 to 1000 for exterior members) before making permanent connections.
 - e. Remove bracing and guys only after permanent alignment and assembly and structure is capable of completely sustaining design and temporary construction loads.
- C. Exposed Steel:
 1. Verify the condition of exposed steel after erection.
 2. Exert particular care to provide a neat, accurate installation with members straight and true, corners and edges square, sharp and free from burrs and irregularities, adjacent members perfectly matched and no bolts or rivets exposed.
 3. Remove erection bolts and seats and plug weld and grind holes smooth.

- D. Touch-up Primer Painting:
 - 1. Remove temporary guys, bracing and bracing clips, and grind flush remaining burrs, before painting. Remove welding slag, spatter, rust and burnt paint and wire brush clean welds before touch-up.
 - 2. Touch-up Primer Painting: Touch-up welds, abrasions, bolted connections, and other areas where shop prime paint has been removed or is damaged with specified prime paint.
- E. Grout Placement: Comply with the manufacturer's instructions.
- F. Tighten anchor bolts after supported members have been positioned and plumbed.

3.03 FIELD QUALITY CONTROL

- A. Field inspections and testing shall be performed by an independent testing and inspection agency in accordance with Section 01 45 00. Refer to general Structural Notes on Drawings for detailed testing requirements.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises.

END OF SECTION

SECTION 05 31 00

STEEL DECK

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Increase S and I properties for simple or two span continuous to achieve equivalent load capacity. Minimum allowable diaphragm shear capacity furnished, per ICC report, shall be as indicated on Structural Drawings.
 - 2. Sections and properties shall meet AISC Specifications.

1.02 SUBMITTALS

- A. Shop Drawings: Submit shop and erection Drawings showing layout, material and fastening methods and each piece to be erected, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. Note deck welding pattern and physical properties of decking. Shop drawings shall not be made by reproduction of the Contract Drawings.
- B. Report: Submit ICC report showing diaphragm shear test.
- C. Submit welders' written certifications and qualifications.

1.03 QUALITY ASSURANCE

- A. Welding: Performed by certified welders in compliance with AWS D.1.3 requirements and procedures for manual shielded metal arc welding.
- B. Certifications:
 - 1. Prior to fabrication or shipment of material to the job site, furnish certification of the manufacturer of the steel decking that material furnished meets or exceeds requirements of ASTM standards specified or noted on Drawings, for each type of material.
 - 2. Prior to site welding operation, submit welders' written certifications and qualifications.
- C. Maintain on file ICBO report showing diaphragm shear test during the course of construction.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle metal decking in manner which will prevent damage or deformation.
- B. Stack decking stored at the site before erection on platforms or pallets, and suitably protect from the weather.
- C. Exercise special care so as not to damage or overload the decking during the construction period.
- D. Do not use metal decking for storage or as a working platform until the sheets have been welded in position.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved otherwise by Architect or Structural Engineer, subject to conformance with Specification requirements:
 - 1. Consolidated Systems, Inc. www.csisteel.com
 - 2. Metal Deck, Inc.
 - 3. United Steel Deck, Inc. www.njb-united.com/usd.htm
 - 4. Verco Manufacturing, Inc. www.vercodeck.com
 - 5. Vulcraft Division, Nucor Corp. www.vulcraft.com/sc
 - 6. Wheeling Corrugating Division www.wheelingcorrugating.com

2.02 RIBBED DECK

- A. Steel: ASTM A653 or ASTM A1008, with Grade and minimum yield strength indicated on General Structural Notes on Drawings.
- B. Roof Deck: Provide steel roof deck of type indicated on Structural Drawings.
 - 1. Fabricate panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck,” in SDI Publication 29.
 - 2. Metal deck used in fire rated assemblies shall meet the requirements of UL. The UL mark on the product shall be acceptable as evidence of compliance.
- C. Finishes:
 - 1. Painted Deck: ASTM A1008, Grade 33.
 - 2. Galvanized to conform with ASTM A924, Grade 60 where indicated.

2.03 ACCESSORIES

- A. Provide ridge and valley plates, closures, cant strips, roof sump pans and other accessories where necessary or as shown on Drawings and of same material and finish as steel deck.
- B. Furnish miscellaneous supporting members at openings and edges, as shown on Drawings and as necessary.
- C. Touch-Up Paint Materials:
 - 1. Galvanizing Repair Paint: High zinc-dust content paint complying with SSPC Paint 20 (94 percent minimum zinc dust content, dry film, by weight).
 - 2. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Erector shall examine subsurfaces to receive Work and report detrimental conditions, in writing, with a copy to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Before proceeding, verify that required inspections of existing conditions have been completed.

3.02 ERECTION - RIBBED DECK

- A. Place deck sheets in accordance with approved erection layout Drawings.
- B. Deck units shall be fabricated to span three or more support spacings, with end laps of at least two inches which shall occur over supports. Male joint of side laps shall engage female joint by at least 5/8 inch.
- C. Openings shown on the erection layout Drawings shall be cut by the deck erector. Openings not shown on the erection diagram, such as those required for stacks, conduits, plumbing vents, etc. shall be cut and reinforced if necessary, by the Trade requiring the openings.
- D. Attach deck to supporting members by fusion welding. Care shall be exercised by the welder in the selection of electrodes and amperage to provide positive welds and prevent high amperage blow holes. Welds shall be made from the top side of the deck with the welder following close behind the placement crew.
- E. Ridge and valley plates, closures, cant strips, roof sump pans and other accessories shall be attached directly to the deck to provide a suitable surface for the application of insulation and/or roofing.
- F. Welding washers are not necessary for ribbed deck of 22 gauge or heavier, or when the bottom rib width equals or exceeds 5/8 inch.
- G. Where washers are required, weld deck to steel framing through 16 gauge welding washers with 1 inch x 3/8 inch puddle welds. Maximum weld spacing shall be as follows unless noted otherwise on the Structural Drawings:
 - 1. End and end laps: 6 inches o.c.
 - 2. Intermediate supports: 6 inches o.c.
 - 3. Edges, perimeter beams and angles parallel to deck flutes: 12 inches on center
 - 4. Opening edges: 6 inches on center
- H. Weld sheets to each other with side seam welds at 12 inches on center.
- I. Touch-up Painting: Immediately after securing deck and other metal components in position, thoroughly clean and touch-up welds and damaged surfaces with specified touch-up repair paint as applicable.

3.03 FIELD QUALITY CONTROL

- A. Tests: When required by the Architect, installation of metal decking and welding shall be subject to inspection by a qualified Testing Agency acceptable to Architect, the cost of which will be paid out of the Testing Allowance.
- B. The Testing Agency shall:
 - 1. Test and inspect metal decking and workmanship to verify compliance with Contract Documents.
 - 2. Check material, equipment, procedures, welds, ability of welders.
 - 3. Furnish Architect with a verified report that completed Work conforms with Contract Documents.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 05 41 00

STRUCTURAL METAL STUD FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes cold-formed structural steel stud framing and supplementary items necessary for complete work required for their installation, including, but not limited to the following:
1. Exterior structural metal stud wall framing as noted including accessories such as clips, stiffeners, bridging, bracing, and fasteners, and necessary steel reinforcing members, stiffeners, bracing including anchorage to building structure.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As follows:
 - a. Dead Loads: Weights of materials and construction.
 - b. Wind Loads: As shown in General Structural Notes.
 - c. Earthquake Loads: As shown in General Structural Notes.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Walls receiving gypsum wallboard finishes: L/240.
 - b. Walls receiving EIFS: L/240.
 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch, typical unless noted otherwise.
- B. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Increase sheet metal gauge and decrease stud spacing as required to withstand the design loads within prescribed deflection limits. Do not increase stud depth without prior approval of the Architect.
- D. Coordinate stud locations with locations of metal panel fasteners and clips. Design studs for the additional concentrated loads due to the metal panel fasteners and clips as required.

1.03 SUBMITTALS

- A. Research reports or evaluation reports from the model code organization considered acceptable to the building officials having jurisdiction over this project that evidence cold formed metal framing is in compliance with building code in effect for project.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed cold formed metal framing similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Welding: Performed by certified welders in compliance with AWS D1.3 Structural Welding Code Sheet Steel.
- C. Maintain Mill Certification on file with shipment to verify chemical composition, yield strength, tensile strength, elongation and coating thickness. Include listing of applicable ASTM standards specified in this section and comparison of ASTM requirements to actual materials provided to jobsite.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.
- B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products as Manufactured by a Manufacturing member of the Steel Stud Manufacturers Association (SSMA) www.ssma.com, subject to compliance with Specification requirements.

2.02 MATERIALS

- A. All studs, track, bracing and bridging shall conform to ASTM C955 – “Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases”. All cold formed products to be fabricated from ASTM A1003 Structural Grade, Type H, metallic coated steel sheet with hot-dip galvanized coating complying with ASTM A653, of grade and coating weight as follows:
 - 1. Grade: ST33H, 33 ksi for 33 and 43 mil studs and joists and ST50H, 50 ksi for 54 mil studs, unless otherwise indicated on General Structural Notes on Drawings.
 - 2. Coating Designation: G60 hot dip galvanized.
 - 3. Elongation: Limit elongation to 12 percent.
- B. Studs: All stud framing members shall be cold formed members of the type, size, gauge, and spacing indicated on Drawings. Manufacturer's standard C-shaped steel studs of web depths indicated and with lipped flanges.
- C. Track: Channel shaped; same width as studs, for tight fit; gauge matching supporting studs minimum, solid web, galvanized at exterior wall locations.
 - 1. Flange Width: Manufacturers deep flange where indicated, standard flange elsewhere.

- D. Framing Accessories: Manufactured from galvanized sheet steel, thickness to be determined for actual project conditions, provide Manufacturer's standard shapes for:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Gusset plates.
 5. Deflection track and vertical slide clips.
 6. Stud kickers and girts.
 7. Joist hangers and end closures.
 8. Reinforcement plates.

2.03 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel hex-head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 x the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws, type appropriate for attachment detail requirements with penetration through joined materials not less than 3 exposed threads.
1. Fastener Head Type:
 - a. Low-profile fastener heads required beneath sheathing, Manufacturer's standard fasteners elsewhere.
 - b. Hex Washer Head for dynamic framing connections.
- F. Welding Electrodes: Comply with AWS standards and as indicated on General Structural Notes on Drawings.

2.04 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.

2.05 FABRICATION

- A. Fabricate cold-formed steel stud framing and accessories plumb, square, true to line, and with connections securely fastened, according to AISI Design Specifications and Code of Standard Practice for Cold-Formed Steel Structural Framing, ASTM C1007 as applicable to fabrication, Structural Drawings, Manufacturer's recommendations, and the requirements of this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel stud framing members by welding or screw fastening. Shop welding of 0.0747 inch (14 gauge) or thicker components is acceptable. Wire tying of framing members is not permitted.
 - a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to cold-framed steel stud framing Manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
 - 3. Fasten other materials to cold-formed steel stud framing by welding, bolting, or screw fastening, according to Manufacturer's recommendations.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.
- C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Square: Fabricate each cold-formed steel stud framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete construction.

3.03 INSTALLATION - GENERAL

- A. Cold-formed steel stud framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel stud framing according to ASTM C1007, unless more stringent requirements are indicated or required by conditions.

- C. Install cold-formed steel stud framing and accessories plumb, square, true to line, and with connections securely fastened, according to Manufacturer's recommendations and the requirements of this Section.
 - 1. Space studs at 16 inches on center maximum unless otherwise indicated. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel stud framing members by screw fastening. Wire tying of framing members is not permitted.
 - a. Locate mechanical fasteners and install according to cold-framed steel stud framing Manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- D. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- E. Provide temporary bracing and leave in place until framing is permanently stabilized.
- F. Do not bridge building expansion and control joints with cold-formed steel stud framing. Independently frame both sides of joints.
- G. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.
- H. Fasten reinforcement plate over web penetrations that exceed size of Manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed steel stud framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 NONLOAD-BEARING CURTAINWALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as required by Structural Drawings.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated in the shop drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate steel framing from building structure at locations indicated to prevent transfer of vertical loads while providing lateral support.
 - 1. Install deflection track with deep or slotted flanges and anchor to building structure.
 - 2. Connect studs with vertical slide expansion/contraction joint and supplementary framing anchored to building structure.
- E. Install horizontal bridging in curtain wall studs, spaced in rows not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Install additional row of horizontal bridging in curtain wall stud beneath deflection track when curtain wall studs are not fastened to an additional top track.

2. Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs or flat, steel-sheet straps of width and thickness indicated, fastened to stud flanges.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain wall-framing system.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Qualified independent testing agency employed and paid by Owner will perform field quality-control testing.
- B. Shop and field welds will be subject to inspection and testing.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace Work that does not comply with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.06 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel stud framing with galvanizing repair paint according to ASTM A780 and Manufacturer's instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to Manufacturer and Installer to ensure that cold-formed steel stud framing is without damage or deterioration at time of Substantial Completion.

3.07 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Metal fabrications, including items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems in other Sections of these Specifications. Types of metal items include, but are not limited to, the following:
1. Pipe and tube bollards.
 2. Ladders for roof access.
 3. Miscellaneous framing and supports including, but not limited to the following:
 - a. Supports for suspended ceiling suspended finishes, fixtures and other items as necessary, including flat screen monitors, equipment, pot racks, fans, fixtures and similar items.
 - b. Applications where framing and supports are not specified in other sections.
 - c. Other items as indicated.
 4. Miscellaneous steel trim.
 5. Steel grating and angle frames for hose drying assembly.
 6. Single and dual neck steel support pedestals for knox boxes, card readers, opti-com device, hose bibs, gate access controls, door activation controls, etc.
 7. Enclosure gates, frames and hardware.
 8. Sliding gates frames and hardware.
 9. Steel tube apparatus bay door jambs and head.
 10. Steel backboard rack.
 11. Decorative steel building wall accents.
 12. Other items as indicated or required.
- B. Related Sections:
1. Division 03 Concrete Sections for gate footings and concrete fill for bollards.
 2. Section 32 31 40 – Gate Operator, for self-contained gate operators for sliding yard gates.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings for the fabrication and erection of enclosure gates and sliding/rolling yard gates.
1. Include plans and elevations at not less than 1 inch to 1'-0" scale, and include details of sections and connections at not less than 3 inches to 1'-0" scale.
 2. Show anchorage and accessory items.

1.03 QUALITY ASSURANCE

- A. Standards: Comply with the following, except as otherwise shown and specified:
1. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
 2. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
 3. AWS "Structural Welding Code-Steel."
 4. ASTM A6 "General Requirements for Rolled Steel Plates Shapes, Sheet Piping and Bars for Structural Use."

- B. Qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

1.04 DELIVERY, STORAGE AND HANDLING

- A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.
- B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

1.05 PROJECT/SITE CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible, to ensure proper fitting of the Work. Allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the Work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Shapes, Plates, Rod, Bars and Bar-size Shapes: ASTM A36.
- B. Steel Pipe: ASTM A501 (Fy = 36 ksi), or ASTM A53, Type E or S, Grade B (Fy = 35 ksi).
- C. Steel Tube: ASTM A500 (Fy = 46 ksi).
- D. Cold-Finished Carbon Steel Bars: ASTM A108, Grade as selected by fabricator.
- E. Hot-rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A1011, pickled and oiled.
- F. Cold-rolled Carbon Steel Sheets: ASTM A1008.
- G. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.
- H. Cold-drawn Steel Tubing: ASTM A512, sunk drawn, butt welded, cold-finished and stress-relieved.
- I. Slotted Channel Framing (Unistrut): 1-5/8 inch by 1-5/8 inch slotted channel framing system as manufactured by Unistrut, or as approved. Galvanized G90, cold-formed metal channels with flange edges returned toward web with 9/16 inch wide slotted holes in webs at 2 inches o.c.
 - 1. Provide Manufacture's standard connectors, fasteners and other miscellaneous accessories as required for a complete installation and connection to supporting structure and as necessary for support of ceiling elements and other items supported.
- J. Gratings: Grating shall be electro-pressure welded construction, hot-dipped galvanized fabrication, type as shown on Drawings or as selected by Architect, and as necessary to support weight fire apparatus vehicle weight classification, exceeding AASHTO H-20. Furnish perimeter support angles with welded anchors as detailed.

- K. Ribbed Steel Deck: ASTM A653 steel, 16 gauge, 1-1/2 inch ribbed B-deck comparable to Vulcraft Type B16, with G90 zinc coating, or as otherwise indicated on Drawings or approved by Architect.
- L. Gray Iron Castings: ASTM A 48, Class 30.
- M. Malleable Iron Castings: ASTM A 47, Grade 32510.
- N. Anchors:
 - 1. Masonry Anchorage Devices: Expansion shield, FS FF-S-325.
 - 2. Toggle bolts: Tumble-wing type, FS FF-B-588; type, class and style as required.
 - 3. Chemical Type Anchors: 2-component chemically curing anchors for concrete or masonry construction, capsule or injection type, designed to accept Manufacturer's galvanized anchor rod.
 - 4. Threaded-type concrete inserts: Galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts; either malleable iron complying with ASTM A47 or cast steel complying with ASTM A27; hot-dip galvanized in compliance with ASTM A153.
 - 5. Wedge-type concrete inserts: Galvanized box-type ferrous castings, designed to accept 3/4 inch diameter bolts having special wedge-shaped heads, either malleable iron complying with ASTM A47 or cast steel complying with ASTM A27; hot-dip galvanized in compliance with ASTM A153.
 - 6. Provide carbon steel bolts having special wedge-shaped heads, nuts washers and shims; all galvanized in compliance with ASTM A153.
- O. Fasteners: Provide zinc-coated fasteners with galvanizing complying with ASTM A153 for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.
 - 1. Bolts and nuts: ASTM A307, Grade A, regular hexagon head.
 - 2. Bolts, hexagon and square: ANSI B-18.2.1.
 - 3. Bolts, round head: ANSI B-18.5.
 - 4. Lag bolts: Square head type.
 - 5. Wood screws: ANSI B-18.6.1, flat head carbon steel.
 - 6. Plain washers: ASTM F844 helical spring type carbon steel.
- P. Metal Primer: VOC compliant.
 - 1. Interior Steel: Tnemec 88HS-0559 Gray www.tnemec.com, modified short oil alkyd; or Tnemec 10-99 modified alkyd, chemically active, rust-inhibitive primer, or equivalent as standard with fabricator.
 - 2. Exterior Steel (exposed, where indicated to be painted):
 - a. Exterior Steel: Tnemec Tneme-Zinc 90-97 aromatic urethane, two-component, moisture-cured, zinc-rich primer.

2.02 ACCESSORIES

- A. Inserts and Anchorages: Furnish inserts and anchoring devices to be set in concrete or built into masonry for installation of Miscellaneous Metal Work. Provide setting Drawings, templates, instructions and directions for installation of anchorage devices.
- B. Concrete Fill (for concrete filled pipe bollards): Comply with requirements of Section 03 30 00 for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi.

- C. Swing Gate Hardware:
 - 1. Hinges for Swing Gates: Provide heavy duty galvanized steel butt hinges sized as required by size and weight of gate.
 - 2. Double Gates: Provide plunger style cane-bolts with pipe receiver set into paving, size as indicated.
- D. Sliding Gate Hardware:
 - 1. Guide Angle: 1-1/4 inch x 1-1/4 inch x 3/16 inch galvanized steel inverted guide angle or tube designed to fit contour of gate wheel welded to 1/4 inch thick minimum steel plate with studs for casting and anchorage into concrete.
 - 2. Tire-V-wheel assembly: 6 inch pneumatic rubber wheel in tandem with a 6 inch diameter in-line ball bearing "V" wheel or truncated "V" wheel designed to operate over inverted guide angle or tube track.

2.03 FABRICATION

- A. General: For fabrication of Miscellaneous Metal Work 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. Remove such blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes, including zinc coatings.
- B. Shop Assembly: Preassemble items in shop, when possible, to minimize field splicing and assembly of units at the site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Workmanship:
 - 1. Use materials of the size and thickness shown, or if not shown, of the required size and thickness to produce adequate strength and durability of the finished product for the intended use. Work to the dimensions of fabrication and support. Use type of materials shown or specified for various components of Work.
 - 2. Form exposed Work true to line and level with accurate angles, surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
 - 3. Weld corners and seam continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
 - 4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flat-head (countersunk) screws or bolts.
 - 5. Provide for anchorage of type shown, coordinated with supporting structure and the progress schedule. Fabricate as required to provide adequate support for the intended use of the Work.
 - 6. Cut, reinforce, drill and tap Miscellaneous Metal Work as may be required to receive finish hardware and similar items of Work.
 - 7. Use hot-rolled steel bars for Work fabricated from bar stock, unless Work is indicated to be fabricated from cold-rolled, or cold-finished stock.
- D. Fabricate pipe bollards from steel pipe or tube of diameter or size indicated on Drawings. Fabricate square steel tube bollards with removable steel cap as detailed on Drawings.

- E. Ladders:
1. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as required. Comply with requirements of ANSI A14.3, except as otherwise shown.
 2. Fit rungs into punched holes in centerline of side rails, plug weld and grind smooth on outer rail faces.
 3. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet o.c. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder 7 inches clear of the wall surface and other obstructing construction. Extend rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.
 4. Provide non-slip surfaces on the top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.
 5. Exterior ladders shall have hot-dipped galvanized finish.
- F. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports which are not a part of the structural steel framework, or other metal systems in other Sections of these Specifications, whether indicated or not as necessary to complete Work.
 2. Fabricate miscellaneous units to sizes, shapes and profiles shown, or if not shown, of the dimensions required to receive adjacent grating, plates, doors or other Work to be retained by the framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars of all welded construction using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.
 3. Equip units with integrally welded anchor straps for casting into concrete or building into masonry wherever possible. Furnish inserts if units must be installed after concrete is poured. Except as otherwise shown, space anchors 24 inches o.c., and provide minimum anchor units of 1-1/4 inch x 1/3 inch x 8 inch steel straps.
- G. Enclosure Gates: Fabricate to sizes and shapes indicated using steel tubing, shapes, plate, ribbed steel deck facing and other steel items as indicated on Drawings.
1. Fabricate with continuously gas-arc welded joints, and smooth exposed edges.
 2. Miter corners and use concealed field splices wherever possible.
 3. Hinges for Swing Gates: Weld heavy duty galvanized steel butt hinges directly to gate frame and support posts.
 3. Double Swing Gates: Provide plunger style cane-bolts with pipe receiver set into paving, size as indicated.
- H. Horizontal Sliding Yard Gates: Fabricate to sizes and shapes indicated using steel tubing, shapes, plate, ribbed steel deck facing and other steel items as indicated on Drawings.
1. Fabricate with continuously gas-arc welded joints, and smooth exposed edges.
 2. Miter corners and use concealed field splices wherever possible.
 3. Rolling/Sliding Gates:
 - a. Horizontal Rolling Gates: Provide roller guides, inverted V-tracks, rails, guides, support angles, etc., as required for smooth operation as indicated.
 - b. Inverted-V Guide Track: Fabricate inverted-V guide angle or tube of shape to fit contour of roller wheel and base plate with anchor studs of length required for full opening width plus gate wheel travel for full open position.

- c. Fabricate tire-V-wheel assembly from 2 inch square tube with ball bearing “V” wheel in alignment with inverted angle guide and in-line with tandem 6 inch pneumatic rubber wheels spaced at approximately 20 inches center to center (10 inches each side of guide wheel).
 - d. Coordinate fabrication with gate operator specified in Section 32 31 40.
- I. Support Pedestals and Frames: Fabricated from steel tube and plate indicated with fully welded joints ground smooth. Coordinate fabrication with card reader, door activation control systems, hose bibs, and other items as indicated specified in other Sections.
- J. Steel Backboard Rack: Fabricate steel backboard rack as detailed on Drawings with steel shapes as indicated. Fabricate with continuously welded joints, and smooth exposed edges.
 - 1. Finish: Provide polyester powder coated finish in color as selected by Architect.
- K. Miscellaneous Steel Trim: Provide shapes and sizes as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other Work.
- L. Prevent galvanic action and other forms of corrosion by insulating contact points between metals and incompatible metals or materials. Provide separation of resilient gasket or other appropriate material to separate aluminum bar gratings and angles where units are attached to steel.

2.04 FINISHING

- A. Galvanizing: Gratings and grating frames shall be hot-dip galvanized after fabrication, including bolts and nuts. Galvanizing shall comply with ASTM A123 and A153 for the hot-dip process after fabrication.
- B. Shop Painting:
 - 1. Shop paint Miscellaneous Metal Work, except those members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated.
 - 2. Remove scale, rust and other deleterious materials before shop coat of paint is applied. Clean in accordance with SSPC SP-2, SP-3, or SP-7, as required. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
 - 3. Apply one shop coat of metal primer paint to fabricated metal items, except apply 2 coats of paint to surfaces which are inaccessible after assembly or erection.
 - 4. Immediately after surface preparation, brush or spray on metal primer paint in accordance with Manufacturer's instructions, and to provide a uniform dry film thickness of 2 mils for each coat.
 - 5. Comply with Section 09 91 00 for application of high performance paint system primer applied to exposed exterior steel shade awnings, steel fins, steel tube headers, and similar items indicated to receive high performance paint system.
- C. Gates: Provide multi-step oven cured TGIC powder coated finish consisting of thorough cleaning, pretreatment, powder coat primer and Ultra polyester finish (TGIC) at 2-4 mils.
 - 1. Color: Custom color as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Shop Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Install pipe bollards in concrete footings plumb and level, accurately fitted, free from distortion or defects. Provide adequate bracing as required to hold bollard in position until concrete has been placed and cured.
 - 1. Fill bollards solidly with concrete and mound top surface to shed water.
- F. Gates:
 - 1. Securely anchor gates and erect plumb, level, and true, with smooth operating hardware.
 - 2. Secure for full opening without interference.
 - 3. Attach hardware by means which will prevent unauthorized removal.
- G. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- H. Prevent galvanic action and other forms of corrosion by insulating contact points between metals and incompatible metals or materials. Provide separation of resilient gasket or other appropriate material to separate aluminum bar gratings and angles where units are attached to steel.
- I. Touch-up Painting:
 - 1. Touch-up welds, abrasions, and other areas where shop prime paint has been removed or is damaged with specified prime paint or galvanizing repair paint.
 - 2. Touch up factory applied powder coat finish surfaces damaged by installation to perfectly match powder coated finish using compatible touch-up paint recommended by powder coat manufacturer.

3.04 ERECTION TOLERANCES

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

3.05 ADJUSTMENT

- A. Lubricate hinges and adjust gates to operate freely. Adjust hardware for smooth operation.

3.06 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Rough carpentry including, but not limited to:
 - 1. Dimensional lumber framing.
 - 2. Wall and roof sheathing, including cricket framing and sheathing at flat roofs.
 - 3. Exterior exposed outriggers, exposed rafters, kickers, 2x lumber trim, and similar items.
 - 4. T&G soffit/ceiling boards and trim.
 - 5. Wall ledgers.
 - 6. Utility and equipment backer panels.
 - 7. Miscellaneous backing, blocking, nailers, sleepers and curbs.
 - 8. Other items as shown on the Drawings and as specified herein.

- B. Related Sections:
 - 1. Section 06 17 00 – Manufactured Structural Wood, for engineered lumber (LVL, LSL, PSL).

1.02 SUBMITTALS

- A. Product Data: Submit technical data for wood preservative and fire-retardant products.

1.03 QUALITY ASSURANCE

- A. Identify each piece of lumber or plywood used for structural framing with grade and trade mark of a lumber grading organization. Trade mark of manufacturer shall also appear on each piece.

- B. Grading Rules: Conform with applicable requirements of American Lumber Standards "Simplified Practice Recommendation R-16" and to grading rules of manufacturer's association under whose rules the lumber is produced.

- C. Standards: Conform with requirements of The Engineered Wood Association, U. S. Dept. of Commerce Commercial Standards and American Wood Preservers Institute Standards (www.preservedwood.com), as they apply.

- D. T&G Deck Boards: Comply with AITC 112, "Standard for Tongue-and-Groove Heavy Timber Roof Decking."

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.

- B. Storage: Store off ground to assure adequate ventilation and protect against damage while stored at the site.

- C. Handling: Comply with manufacturer's instructions.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements: Store materials for which a maximum moisture is specified in areas where humidity can be controlled.

PART 2 PRODUCTS

2.01 LUMBER MATERIALS

- A. Species: Douglas Fir – Larch, Hem Fir graded in accordance with Standard Grading and Dressing Rules of WCLIB. Framing lumber shall be stress grade. All sides shall be surfaced, except where indicated to be rough sawn. Provide Redwood for use at exposed curbing and supports for roof mounted equipment.
- B. Lumber Grades: Provide dimensional lumber framing of grades indicated on General Structural Notes on Drawings, and the following:
 - 1. One inch boards: Construction.
 - 2. Misc. blocking, bridging, etc: Utility.
 - 3. Grounds and furring: Construction Grade Douglas Fir or No. 2 White Pine.
 - 4. Use edge grain or vertical grain boards as preferred cut for fascia and trim boards to help prevent cup and bow.
- C. Exposed Exterior Wood Framing and Trim: AWI Grade III Douglas Fir, moisture content of 6-8 percent, with flat grain, of quality suitable for stained finish. Provide in sizes and profiles indicated on Drawings.
 - 1. All sides shall be surfaced, unless indicated on the Drawings to be rough sawn.
 - 2. Backout or groove backs of flat trim members and kerf backs of other wide, flat members. Terminate kerf or groove short of end of members with ends exposed in finished work.
- D. Finger jointed studs may be used if grade stamped to meet Grade(s) indicated on Structural Drawings and in accordance with Standard Grading Rules specified herein.
- E. Moisture Content:
 - 1. Lumber shall be air-dried or kiln-dried.
 - 2. At time of installation, moisture content, expressed as a percentage of the weight of the oven-dry wood, shall not exceed 19 percent for lumber of up to two inches nominal thickness and 15 percent for exterior trim and siding.
 - 3. Moisture content of lumber over two inches nominal thickness shall conform to the rules of the association under which it is graded.
- F. Engineered Lumber (LVL and PSL): As specified in Section 06 17 00.

2.02 T&G DECKING

- A. Solid Wood, Matched T&G Boards: Standard tongue-and-groove or double tongue-and-groove deck boards, solid, of the following unit grade of the indicated pattern in the required species:
 - 1. Species and Grade: Douglas Fir or Hem-Fir Select(ed) Decking or Select Dex.
 - 2. Pattern and Dressing: Tongue and groove, surfaced two sides or rough sawn as indicated on Drawings or as selected by Architect.
 - 3. Actual face width (coverage) and thickness measured at 19 percent moisture content.
 - 4. Face Width: As indicated on Drawings.
 - 5. Board Length(s): Random lengths, 48 inches minimum.

- B. Moisture Content: Provide wood decking fabricated from kiln-dried lumber of 19 percent moisture content complying with DOC PS 20, and include S-DRY or similar indication in grade marking or certification of grade.

2.03 SHEATHING MATERIALS

- A. General:
 - 1. Panel thickness and identification index shall be as shown on the Drawings and as specified and shall also be stamped on each piece of sheathing.
 - 2. Design of project is based upon plywood sheathing, however, OSB Board may be substituted for plywood if it conforms to all requirements for plywood installed in like locations.
 - 3. Plywood (or OSB Board where allowed) which has an edge or surface permanently exposed to the weather shall be exterior type.
- B. Plywood: Each panel of softwood plywood shall be identified with the APA grade-trademark and shall meet the requirements of PS-1-83 for softwood plywood.
- C. Plywood Backing Panels: For mounting of telephone and electrical equipment, provide Grade C-D Exposure 1 plywood panels, 15/16 inch thick, unless otherwise indicated.
- D. OSB Board:
 - 1. Raw materials used in panel shall be manufactured from wood products conforming to ANSI A201.1.
 - 2. Each piece shall be stamped in accordance with American Plywood Associations (APA) grade rules and shall meet requirements of latest edition of U.S. Product standard for Softwood Plywood.
 - 3. Provide Grade 2-M-W or 2-M-F as required for thickness and application.

2.04 FACTORY WOOD TREATMENT

- A. Preservative Treatment:
 - 1. Materials:
 - a. Chromated copper arsenate (CCA) shall not be allowed.
 - b. Provide ammoniacal copper quaternary (ACQ) or copper boron azole (CBA) as produced by the following manufacturers:
 - 1) Lonza Wood Protection www.wolmanizedwood.com or www.naturalselect.com.
 - 2) Viance Treated Wood Solutions; Viance, LLC www.treatedwood.com
 - 3) Osmose, Inc., Wood Preserving Division, www.osmosewood.com.
 - 2. Locations Required:
 - a. Wood sillplates and ledgers bolted in direct contact with concrete foundations and slabs-on-grade or masonry located at or below grade only shall be pressure treated lumber.
 - b. Blocking occurring on top of or above the roof deck, including the nailer beneath the flashing at parapet caps, shall be treated lumber.
 - c. Other locations as required by Code.
- B. Fire-Retardant Treatment: Lonza Wood Protection www.wolmanizedwood.com Dricon FRTW, or Hoover Treated Wood Products www.frtw.com, Pyro-Guard; in accordance with UL label.
 - 1. Where required by code or indicated on Drawings, wood utility backer panels, blocking, etc., shall be fire-retardant treated.
 - 2. Dimensioned lumber shall be kiln dried to a maximum moisture content of 18 percent before and after milling and fire protective treatment.

2.05 ACCESSORIES

- A. Nails: Common wire, galvanized for exterior Work, meeting ASTM F1667 of the sizes indicated on the Drawings.
- B. Screws: Standard domestic manufacture, bright steel, except galvanized for exterior use and of brass, bronze, aluminum or stainless steel when used to attach items made of those materials. Screws used for attaching interior trim and finish to drywall partitions shall be Type S self-drilling, self-tapping corrosion resistant coated steel drywall screws of required lengths as specified in Section 09 29 00.
 - 1. Screws used for attaching preservative treated wood shall be Type S self-drilling, self-tapping corrosion resistant coated steel screws. Acceptable products include the following:
 - a. DEC-KING Exterior Wood Screw with Climacoat.
 - b. Tapcon Concrete Anchor with Blue Climaseal or White UltraShield.
 - c. Wood-To-Metal TEKS with Grey Spex.
 - d. Roofgrip with Spex or Blue Climaseal.
 - e. GY-FAST Nail with Climacoat.
 - f. Maxi-Set Tapcon White UltraShield.
- C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers as indicated. Bolts, nuts and washers, wholly or partially exposed on exterior shall be galvanized.
 - 1. Provide head design as selected by Architect for exterior exposed applications.
- D. Structural Bolts: Machine bolts, or carriage bolts, of structural grade steel with square nuts, conforming to ASTM A307.
 - 1. Provide head design as selected by Architect for exterior exposed applications.
- E. Steel plates and angles: ASTM A36, galvanized after fabrication.
- F. Lag screws, shear plates and split ring connectors: Conform to requirements of the "National Design Specifications for Stress Grade Lumber and its Fastenings" of National Forest Products Association.
- G. Framing anchors and joist hangers: Simpson Company products or similar devices as approved by Structural Engineer through Architect and noted on Drawings.
- H. Power driven inserts: Ramset, or as approved by Structural Engineer through Architect meeting FS GGG-D-777a. Install as per manufacturer's printed directions. Charge shall be powerful enough to prevent spalling of concrete.
- I. Galvanizing: ASTM A653.
- J. Toggle Bolts: FS FF-B-588.
- K. Fabricated Connections:
 - 1. Sheet metal galvanized of size and type shown on Drawings.
 - 2. Structural Steel: ASTM A36. Welding by qualified welders in conformance with AWS D1. One shop coat of paint per Federal Specification TT-P-86, Type II to parts not embedded.

- L. Sill Sealer Gasket: Owners Corning “FoamSealR” or GreenGuard Sill Sealer; 1/4 inch foam sill plate gasket, or equivalent as approved by Architect.
- M. Joint Sealant: Silicone sealant complying with Section 07 92 00.

PART 3 EXECUTION

3.01 FRAMING

- A. Coordination: Install wood framing making proper provisions for Work of other trades. Cut wood required to accommodate plumbing, heating and ventilating, electrical and other trades. Fit neatly around exposed items, as outlet boxes, conduit, pipes and ducts. Protect adjacent Work. Before proceeding with rigid sheathing, make certain required inspections have been made by Building Official.
- B. Structural Members: No cutting, notching or drilling without prior approval of the Structural Engineer through the Architect.
 - 1. Fabricate and install wood framing and sheathing which is exposed in the finished work with grade stamps concealed from view or removed.
- C. Wood Backing: Provide wood backing, furring, stripping or blocking indicated or required for installation and attachment of work of other trades. Provide fire-proofed wood backing approved by Building Official where required by Code in noncombustible or fire-rated construction.
- D. Connections: Subdrill where necessary to avoid splitting.
- E. Bolts: Drill bolt holes 1/32 inch larger than bolt diameter. Use square plate or malleable iron washers under heads and nut where they bear against wood. Re-tighten bolts immediately prior to concealing with finish materials. Re-tighten exposed bolts immediately prior to final inspection by Building Official.
- F. Lag Screws and Screws: Subdrill, use square plate or malleable iron washer under lag screw heads when they bear on wood.
- G. Exterior base plates or sills resting on concrete: Set sill plates on sill sealer gasket. Size plates or sills and set level and true to line. Bolt down with bolts of size, length and spacing indicated with a bolt not more than 9 inches from the end of any piece.
- H. Apply a continuous bead of joint sealant at interior side of top of sill plate and exterior wall sheathing. Clean sill plate and wall cavity area of all dirt and debris before applying joint sealant.
- I. Studs: Wall and partitions shall be nominal 2x4 and 2x6 studs 16 inches on center unless otherwise noted or unless they are required to be larger to accommodate mechanical or electrical equipment, piping and fixtures or fixtures or equipment of any other Trade. Unless otherwise detailed, panels, valve covers, cleanouts, devices, access doors, recessed cabinet boxes, etc., shall be mounted flush with the adjacent wall surface. When any such item is of a depth where it is not practical to use solid studding to the full thickness of the wall, then the wall shall be furred. When furring is required, it shall extend the full width and from floor to roof or ceiling joists. The studs comprising interior partitions and the wall material affixed thereto shall extend from floor to roof or ceiling joist framing except as shown. Staggered stud walls shall be constructed where shown on plans and as detailed.

- J. Rough Framing: Fit closely, set accurately to required lines and levels, and secure rigidly in place. Set horizontal and inclined members with crown edge up. Reinforce cut members as directed by Structural Engineer through Architect. Bolt, nail and spike in a thorough manner with not less than the sizes and quantities indicated or specified. Structural members shall provide full contact at bearing surfaces.
- K. Top plates in bearing partitions: Shall be doubled and lapped at each intersection with walls or partitions. Stagger joints in upper and lower members of top plate not less than 4 feet.
- L. Provide blocking not less than 2 inches in thickness of same width as stud as follows:
 - 1. Stud partitions or walls more than 8 feet , but not more than 14 feet in height: One row of blocking fitted snugly and nailed into mid-height of stud.
 - 2. Walls or partitions over 14 feet in height: 2 or more rows of blocking. Locate rows of blocking so that in no case will the distance between sole or top plates and blocking or between lines of blocking exceed 8 feet.
 - 3. Provide solid fire blocking at ceiling line at dropped ceilings and at other locations indicated on Drawings or required by Code.
- M. Frame corners solid where stud walls or partitions meet or as shown on the Structural Drawing.
- N. Provide double joists under partitions parallel to joists, and for headers and side members at openings larger than 4 feet in dimension.
- O. Joist framing into headers and header joists shall be supported on joist hangers.

3.02 T&G DECKING

- A. T&G Soffit Boards/Decking: Install to comply with referenced decking standard and with end joints located over solid bearings according to lay-up indicated on Drawings or General Structural Notes on Drawings. Apply joint sealant between decking and supports and between tongues and grooves at outside wall supports.
- B. Blind-nailed through tongue prior to attaching next board. Face nail and countersink final board and fill holes which will be exposed to view in the finished Work with matching wood filler, sanded smooth.
- C. Provide temporary waterproof covering to protect exposed decking before applying sheathing and roofing.

3.03 PLYWOOD SHEATHING

- A. General: Comply with applicable recommendations contained in APA Form No.E30, "APA Engineered Wood Construction Guide," for types of structural use panels and applications indicated.
 - 1. Comply with "Code Plus" of the above-referenced guide.
- B. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. ICC NER-272 for power-driven fasteners.
 - 2. IBC Table 2304.9.1, Fastening Schedule."
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- D. Sheathing and subflooring shall have edges blocked and nailed for diaphragm or shear wall stresses as shown on the Drawings.

- E. Subflooring shall be glued and nailed.
- F. At non-tongue and groove sheathing, provide plywood clips at 24 inches O.C. maximum at unsupported or unblocked edges.

3.04 PLYWOOD BACKING PANELS

- A. Plywood Backing Panels: Install with the “C” or best face on exposed side.

3.05 CLEANING

- A. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of away from premises.

END OF SECTION

SECTION 06 16 43

EXTERIOR GYPSUM SHEATHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Glass-mat faced water-resistant exterior gypsum sheathing used for soffit applications as shown on Drawings and as specified herein.

1.02 DEFINITIONS

- A. Gypsum Board Construction Terminology Standard: Refer to ASTM C1177 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this Section or other referenced standards.

1.03 SUBMITTALS

- A. Product Data: Submit Manufacturer's data sheets including product specifications, material composition, thickness, sizing, design data and installation instructions.
- B. Copy of Warranty.

1.04 QUALITY ASSURANCE

- A. Comply with applicable specification recommendations of GA-216 and GA-600 as published by the Gypsum Association.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging, containers, and bundles with Manufacturer's brand, product identification markings and brand intact.
- B. Storage: Store panels flat and level in an enclosed shelter providing protection from damage and exposure to the elements. Insure adequate air circulation is allowed around material stacks.
- C. Handling: When loading, unloading, and moving materials use care not to cause breakage or edge damage.

1.06 SEQUENCING AND SCHEDULING

- A. Sequence installation of exterior gypsum sheathing so sheathing will not be left exposed longer than recommended by manufacturer or 180 days, whichever is less, prior to installation of exterior cladding.

1.07 WARRANTY

- A. Furnish Manufacturer's standard 10 year limited warranty covering defects in manufacturing and materials and maximum 1 year exposure warranty stating that product will remain free of defects and suitable for its intended use after installation, but before the exterior weather-resistive barrier or cladding is installed on the building, regardless of exposure to normal weather conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements:
1. CertainTeed Corp., Saint Gobain www.certainteedcorp.com
 2. Georgia-Pacific Gypsum (GP) www.buildgp.com
 3. National Gypsum Company www.nationalgypsum.com
 4. Pabco Gypsum www.pabco gypsum.com
 5. USG www.usg.com

2.02 MATERIALS

- A. Glass Mat Faced Exterior Sheathing Board: Glass-mat faced exterior gypsum sheathing complying with ASTM C1177.
1. Thickness: 5/8 inch.
 2. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - a. DensGlass Sheathing, G-P Gypsum Corporation.
 - b. GlasRoc Sheathing, CertainTeed Corp.
 - c. Gold Bond BRAND eXP Sheathing, National Gypsum Company
 - d. PABCO GLASS Sheathing, Pabco Gypsum
 - e. Securock Brand Glass-Mat Sheathing, USG

2.03 ACCESSORIES

- A. Fasteners: Type S-12, bugle head, self-tapping, with organic-polymer or other protective coating having a salt-spray resistance of more than 800 hours as tested in accordance with ASTM B117, and as follows:
1. Length: As recommended to penetrate wood or metal framing minimum depth as recommended by sheathing Manufacturer.
- B. Joint Treatment Materials:
1. Joint Sealant: Silicone emulsion sealant complying with ASTM C834 and compatible with sheathing and sheathing tape as recommended by the sheathing Manufacturer. Provide one of the following:
 - a. Dow Corning 795 Building Sealant.
 - b. Pecora 895.
 2. Glass Fiber Sheathing Tape: Provide self-adhering glass-fiber tape, 2 inch minimum width, 10 x 10 or 10 x 20 threads/inch mesh, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board with a history of successful in-service use.
- C. Continuous Vented Soffit Reveals: Continuous linear soffit reveal vent, width as indicated on Drawings by depth to soffit sheathing and indicated finish; 6063 T5 extruded aluminum or electro-galvanized steel, baked-on primer finish. Provide product(s) indicated on Drawings as manufactured by Fry Reglet, Superior, or equivalent as approved by Architect.
1. Provide manufacturers standard end/termination caps at all ends.
- D. Edge Trim: GA216; Type L bead; electro-galvanized steel and Type LC rolled-formed zinc.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Verify that surface of framing members do not vary more than 1/4 inch from the plane of faces of adjacent members.
- C. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Glass Mat Exterior Sheathing Board:
 - 1. Install in accordance with GA-253, ASTM C1280, IBC requirements and manufacturer's printed instructions.
 - 2. Verify that surface of framing members do not vary from more than 1/4 inch from the plane of faces of adjacent members.
 - 3. Install glass mat gypsum sheathing with logo side out.
 - 4. Panels of the maximum length possible shall be used to minimize the number of joints. Edge joints must be located parallel to and with vertical orientations on framing. End joints of adjacent lengths of sheathing must be staggered.
 - 5. Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - a. Install boards with 3/8-inch setback where abutting structural elements.
 - b. Install boards with 1/4-inch setback where they abut masonry or similar materials that might retain moisture, to prevent wicking.
 - c. Allow no joints greater than 3/8 inch.
 - 6. Install fasteners so screw heads bear tightly against and flush with surface of sheathing but do not cut into facing. Fasteners must not be countersunk.
 - 7. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- B. Ceiling/Soffit Applications: Install with long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners a maximum of 8 inches o.c., or tighter where recommended by the sheathing Manufacturer, and a minimum of 3/8 inch from edges and ends of boards.
 - 2. Place edge trim where gypsum sheathing abuts dissimilar materials and as indicated on Drawings.
 - 3. Apply joint tape over joints and embed in setting type joint compound. Skim coat entire surface with setting type joint compound for smooth finish, except where ceiling or soffit board serves as a base to another applied finish (synthetic stucco, EIFS, etc).
 - 4. Where indicated to be painted, finished surface to be coated with Drywall Primer prior to application of paint system specified in Section 09 91 00.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 06 17 00

MANUFACTURED STRUCTURAL WOOD

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Laminated Strand Lumber (LSL), Parallel Strand Lumber (PSL), and/or Laminated Veneer Lumber (LVL) beams, headers, rim joists and similar members indicated on Drawings or used at contractors option to sawn lumber indicated.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for review before fabrication begins, conforming to the design load criteria shown on the Drawings.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Members shall be stored in a vertical position, in a dry place, completely protected from the weather. Members shall be handled with care to prevent damage.

1.04 PROJECT CONDITIONS

- A. Verify dimensions shown on Drawings by taking field measurements; proper fit and attachment of members is required.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as approved by the Architect, subject to compliance with specifications requirements:
 - 1. Georgia-Pacific Wood Products; www.buildgpc.com
 - 2. Louisiana-Pacific Corporation; www.lpcorp.com
 - 3. RedBuilt Engineered Wood Products; www.redbuilt.com
 - 4. Roseburg Forest Products www.roseburg.com
 - 5. Weyerhaeuser – TrussJoist Engineered Wood Products; www.woodbywy.com

2.02 MATERIALS

- A. Engineered LSL, PSL, and LVL Lumber: Factory manufactured beams, headers and similar members composed of wood strand elements arranged with grain generally parallel to member length, Laminated Strand Lumber (LSL), Parallel Strand Lumber (PSL), and/or Laminated Veneer Lumber (LVL), pressure laminated with adhesive to form composite beam members.
 - 1. Adhesive: Exterior type complying with ASTM D2559.
 - 2. Design: Beams and Engineered Lumber shall be sized and detailed to fit the dimensions and loads indicated on the plans. Designs shall be in accordance with allowable values and section properties assigned and approved by the building code. Verification of design of the beams by complete calculations is to be available upon request.

PART 3 EXECUTION

3.01 ERECTION

- A. Where shown on Drawings, engineered lumber beams, headers, rim joists, and similar members shall be erected in accordance with the drawings and fabricators installation suggestions. Temporary construction loads which cause member stresses beyond design limits are not permitted.
- B. Erection bracing and blocking in addition to that specified bridging is to be provided to keep the joists straight and plumb as required to assure adequate lateral support for the individual joists and the entire system until the sheathing material has been applied.
- C. Contractor shall notify the Architect prior to enclosing joists to provide the opportunity for inspection of the installation.
- D. Temporarily removing web members, drilling or cutting chords or webs will not be permitted without written permission from Architect.
- E. Coordinate with other trades whose Work relates to beam or joist member installation.

3.02 CLEANING

- A. After erection, remove unused materials, tools, scaffolding and debris and leave broom clean.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Prefabricated wood trusses as shown on the Drawings and as specified. Miscellaneous fastening devices, except for connector plates, are specified elsewhere.

1.02 SUBMITTALS

- A. Shop Drawings: Submit engineering drawings conforming with the design load and deflection criteria shown on the Drawings for review before fabrication begins. These drawings shall bear the seal of a registered professional Engineer. See structural drawings for additional requirements.

1.03 QUALITY ASSURANCE

- A. Design: Trusses shall conform with applicable provisions of the following:
 - 1. NDS-2012 for lumber.
 - 2. TPI-85 for criteria.
 - 3. IBC for code compliance.
- B. Report: Submit ICC report for metal connectors.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Handling: Handle fabricated trusses and subassemblies with care so that they are not subject to damage. During the construction period, provide means for adequate distribution of concentrated loads so that the carrying capacity of any one truss or other component is not exceeded.
- B. Storage: If the trusses are to be stockpiled or stored prior to erection, set in vertical positions and rest upon temporary bearing supports and brace so they will not be subject to unusual bending or tip over.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements and checking shop drawings details before proceeding with fabrications.

1.06 SCHEDULING

- A. Time delivery and installation of trusses to avoid delaying other trades whose work is dependent on or affected by the carpentry work and to comply with protection and storage requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fabricate trusses in accordance with approved engineering drawings.
- B. Moisture Content: The average moisture content of lumber 2 inches or less in thickness shall be 19 percent or less at time of enclosure.
- C. Lumber defects such as wane or knots occurring in the connector plate area shall not affect more than ten percent of required plate area, or number of effective teeth required for each truss member.
- D. Connector Plates: Minimum of 0.036 inch thick and manufactured from ASTM A653 Grade A steel, hot dip galvanized to meet Coating Designation G60. In highly corrosive environments or when fire retardant lumber is specified, furnish stainless steel connector plates in lieu of hot dip galvanized.

2.02 FABRICATION

- A. Cut members accurately to length, angle and true to line to assure tight joints for the finished truss. Place members and connector plates in special jigs with the members tightly clamped in place and maintain in that position until the connector plates have been pressed into the lumber simultaneously on both sides of the joints. Do not permit open joints which depend on the stiffness of the metal connector plates to transmit stresses or improperly fitting joints. Build camber into the member, as noted, by properly positioning the members in the fabricating jig.
- B. Apply connector plates to both faces of truss at each joint to provide firm even contact between the plate and the wood. Wood members shall be accurately cut and fabricated so that members have good bearing and completed truss units are uniform. See Truss Plate Institute Quality Standard for Metal Plate Connected Wood Trusses QST-88 for tolerances and other special requirements.

PART 3 EXECUTION

3.01 ERECTION

- A. Coordinate with other trades whose work relates to truss installation.
- B. Securely brace and block trusses both during erection and after permanent installation, in a building in accordance with Commentary and Recommendations (BWT-80) as published by the Truss Plate Institute and the manufacturer's written instructions. Erection bracing and blocking shall hold trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened forming a structurally sound roof framing system.
- C. Install erection and permanent bracing and blocking and permanently fasten trusses before application of loads. Permanent structural cross bracing to ensure overall rigidity of the roof system shall be in accordance with the project Structural Drawings. Check truss design drawings for additional special bracing or blocking requirements.
- D. Unless otherwise indicated on the Drawings, nailing shall be as required to assemble and secure wood construction, but in no case less than that required by applicable building codes. Connectors shall have current ICC approval.

- E. Unless specifically shown, wood plugs or nailing blocks shall not be used. Powder cartridge driven units may not be used on structural members without prior approval. Provide nails, strikes, screws, straps and similar items of suitable type and sizes to attach and hold members securely in place as may be necessary.
- F. Bridging: Install a continuous line of 2 inches x 4 inches bridging connected to each member at the web or chord member during the erection stage. Provide one line along the top and one line along the bottom chord.
- G. Alignment: Erect members with the top and bottom chords in true vertical alignment. Align top chords of trusses parallel to each other and straight with no point in the plane on the top chords more than 3/8 inch out of true horizontal.

3.02 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 06 18 13

GLUE-LAMINATED BEAMS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Shop Drawings: Submit drawings showing materials, dimensions and erection details.

1.02 QUALITY ASSURANCE

- A. Standards: Design, fabrication and construction of structural glue-laminated timber shall conform to applicable requirements of the following:
 - 1. ANSI/AITC A190.1.
 - 2. CS-253.
- B. Laminator shall have minimum 5 years of continuous experience immediately prior to fabricating beams of this project.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Store members on supports not less than 12 inches above ground or 1-1/2 inches above subfloors, as applicable.
- B. Individually wrap members for protection during shipment, storage and erection with manufacturers standard protective weather wrap. Contractor shall continue to protect members after erection and until acceptance of Work.
- C. Protect members during unloading, hauling and erection. Field-trimmed ends or surfaces shall receive a coat of penetrating type sealer prior to erection.

1.04 PROJECT/SITE CONDITIONS

- A. Measurements: Verify dimensions shown on Drawings by taking field measurements; proper fit and attachment of members is required.

1.05 SCHEDULING

- A. Contractor and fabricator shall coordinate construction and delivery schedules. Members shall not be delivered to site until adequate preparation for storage has been made and not erected until preparations to receive members are complete, including miscellaneous metal and connecting hardware embedded in concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Lumber:
 - 1. Lumber for laminating shall be of such stress grade to provide glue-laminated members with normal working stress values of 2400 p.s.i. in bending.
 - 2. Moisture Content: At time of gluing, moisture content of lumber shall not be less than 7 percent and shall not exceed 11 percent. The range of moisture content of various laminations assembled into a single member shall not exceed 5 percent.

- B. Adhesive:
 - 1. Mixing, spreading, storage life, pot life, working life and assembly life of adhesive shall be per manufacturer's recommendations. Use exterior type adhesives.
 - 2. Comply with ANSI/AITC A190.1 for wet-use (dry-use) adhesive.

2.02 FABRICATION

- A. Fabricate with adequate plant and equipment and under supervision of properly qualified personnel.
- B. Laminations shall be machine finished, but not sanded, to a smooth finish and to a uniform thickness with a maximum allowable variation of 1/64 inch.
- C. Provide members conforming to AITC Architectural appearance grade where exposed to view and Industrial appearance grade where concealed from view in the final construction in accordance with AITC-110.
- D. Warp, twist or other characteristics which prevent contact of adjacent glued faces or interfere with uniform bending when under clamping pressure not permitted. Surfaces to be glued shall be clean and free from oil, dust and other foreign material detrimental to gluing.
- E. Identification: Each completed member shall bear a specific identification, for location and shall be accompanied by an AITC Inspection Certificate provided by the fabricator.
- F. Connecting Hardware:
 - 1. Connecting hardware indicated on Drawings shall be furnished by fabricator of glue-laminated members.
 - 2. Steel plates, angles and other shapes: Conform to ASTM A36.
 - 3. Bolts: Conform to ASTM A307. Make bolt lengths such that threads are excluded from bearing on wood or steel. Provide standard malleable iron or equivalent steel plate washers under bolt heads or nuts bearing on wood.
 - 4. Lag screws, shear plates and split ring connectors: Conform to "National Design Specifications for Stress Grade Lumber and Its Fastenings" of National Forest Products Association.
 - 5. Accurately locate bolt holes and drill with a bit 1/16 inch larger in diameter than bolt. Install lag screws, shear plates and split ring connectors per National Design Specifications.
 - 6. Galvanizing: Fabricated steel base assemblies shall be by hot-dip process per ASTM A123 after fabrication.
 - 7. Shop paint: Coat connecting hardware except galvanized base, not embedded in concrete, with one coat of primer per Federal Specification TT-P-645.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect members in accordance with AITC-105 and the instructions of the fabricator.
- B. Handling or erection of tools, equipment and methods shall avoid scarring corners and faces or otherwise injuring the member. Sharp instruments or unprotected wire rope or chain slings not permitted.

- C. Erect laminated wood members true and plumb. Install temporary bracing wherever necessary to take care of loads to which structure may be subjected, including erection equipment, and to keep structure and members in alignment.
- D. Leave temporary bracing in place as long as required for safety and until no longer required to maintain position. As erection progresses, securely bolt up to take care of dead loads, lateral forces and erection stresses. Tie temporary bracing to adequate support.

3.02 FIELD QUALITY CONTROL

- A. Inspection and Testing:
 - 1. Inspection of beams and their connections prior to erection and after erection, at the jobsite, shall be by an ICC certified independent inspector with minimum five (5) years of experience in inspecting glulam beams and their framing.
 - 2. Where, as cautioned by AITC, tension may occur perpendicular to grain due to wood shrinkage restrained by connection or other reasons, the laminator shall install vertical dowels in glued holes to arrest cracks.
 - 3. Size of dowels and the spacing shall be determined by the laminator for each specific occurrence, regardless of when such cracks occur.
 - 4. Tension lamination finger joints shall be proofload tested and test results submitted for review.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Architectural woodwork as shown on Drawings and as specified herein, including, but not limited to, the following:
 - 1. Plastic laminate faced cabinets including dorm units, mailbox cubbies, and other items as indicated.
 - 2. Sub-tops for solid surfacing countertops specified in Section 12 36 61.
 - 3. Storage shelving.
 - 4. Hardwood bench seats.
- B. Related Sections:
 - 1. Section 05 50 00 – Metal fabrications, for custom steel bench frame and legs.
 - 2. Section 06 20 00 – Finish Carpentry, for wood trim for cementitious wood-fiber ceiling panels.
 - 3. Section 12 31 00 – Manufactured Metal Casework, for custom fabricated stainless steel casework and countertops
 - 4. Section 12 36 61 - Solid Surface Countertops, for solid surfacing material countertops and backsplashes.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing layout, dimensioned plans and elevations, adjacent conditions, large-scale details, hardware, attachment devices, and schedule of finishes. Field verify critical dimensions.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and cutouts and holes for plumbing fixtures, faucets, and other items.
- B. Samples:
 - 1. Submit four Samples of each specified or scheduled plastic laminate for verification purposes.
 - 2. Submit samples of stainless steel sheet to be used for countertops, sinks and wall cladding.
 - 3. Submit four Samples of each type of hardware specified or required.
- C. Woodwork Quality Standard Compliance Certificates: AWS Quality Certification Program Certificates.
- D. Qualification Data: For fabricator.

1.03 REFERENCES

- A. Reference Standards: Comply with the following:
 - 1. Architectural Woodwork Standards (AWS), Edition 2.
 - 2. ANSI/NEMA LD3 for laminates.

1.04 QUALITY ASSURANCES

- A. Qualifications: Manufacturer shall be company specializing in manufacturing the products specified in this Section with minimum 5 years documented experience. Shop shall be a certified participant in AWS's Quality Certification Program.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWS's "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide AWI Quality Certification Program certificates indicating that woodwork, including installation, complies with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
 - 3. Standard of Quality: Comply with the following, unless otherwise indicated on Drawings:
 - a. Premium Grade, unless otherwise indicated.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Storage: Adequately protect against damage and moisture while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.07 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS - PLASTIC LAMINATE

- A. Furnish high pressure decorative laminate products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. Formica www.formica.com
 2. Wilsonart www.wilsonart.com
 3. Nevamar www.nevamar.com
 4. Laminart www.laminart.com
 5. Pionite www.pionite.com
 6. As approved by Architect.

2.02 MATERIALS -GENERAL

- A. Provide materials that comply with requirements of AWS's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

2.03 WOOD MATERIALS

- A. Softwood Lumber (Concealed Locations): Graded in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, Douglas Fir species, plain sawn, moisture content of 6-8 percent, with flat grain, of quality suitable for transparent finish. Thicknesses as indicated on Drawings.
- B. Hardwood Bench Tops: Solid hardwood lumber tops fabricated from solid hardwood boards glued under pressure.
1. Wood species, thickness and configuration indicated on Drawings, or as otherwise selected by Architect.

2.04 SHEET MATERIALS

- A. Softwood Plywood: DOC PS 1, MDO (Medium Density Overlay), or other overlay plywood product suitable for application of plastic laminate as approved by the Architect.
- B. Thermofused Decorative Overlay (Melamine): Roseburg Thermally Fused Melamine Panels as manufactured by Roseburg Forest Products (800) 245-1115 www.rfpco.com.
1. Substrate: Roseburg Ultrablend, Roseburg Pine Particleboard or Medium Density Fiberboard (MDF).
 - a. Color: As scheduled on Drawings, or as otherwise selected by Architect.
- C. Prefinished Particleboard: Thermofused Roseburg Melamine on core material of 45 lb. particleboard as manufactured by Roseburg Forest Products (800) 245-1115.
- D. Wood Particleboard: Standard in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, composed of wood chips, 45 lb. density, made with water resistant adhesive; of grade to suit application; sanded faces for drawer construction and shelving.
- E. Baltic Birch Plywood: Manufactured in accordance with Russian Export GOST 3916.1-96 Standards, Type II Glue; Grade B where visible on the exterior of the cabinet, Grade BB at cabinet interior locations.

- F. Medium Density Fiberboard (MDF): Medite II (or Medite FR as applicable) as manufactured by SierraPine, Roseville, CA, 800-676-3339 www.sierrapine.com, or equal as manufactured by Roseburg Forest Products www.rfpco.com, complying with the following:
 - 1. Water-Resistant MDF: Provide Medex in lieu of Medite II at all wet areas or within 2 feet of any sink or source of water.
- G. Marine Grade Plywood: APA 3/4 inch B-B Marine Grade pressure preservative treated plywood.
- H. Hardboard: Pressed wood fiber with resin binder, tempered grade, 1/4 inch thick, smooth one side, for drawer bottoms, gables and backs.
 - 1. Provide perforated hardboard (Pegboard) where indicated.

2.05 LAMINATE MATERIALS

- A. Plastic Laminate: High pressure decorative type.
 - 1. Horizontal Grade: NEMA LD-3, Grade GP50, .050 inch thickness.
 - 2. Horizontal Grade (Color-Thru): NEMA LD-3, Grade GP50 with color extending through material thickness.
 - 3. Vertical Grade: NEMA LD-3, Grade GP28, (.028 inch thickness).
 - 4. Post Forming Grade: NEMA LD-3, Grade PF 42.
 - 5. Cabinet Liner Grade: NEMA LD-3, Grade CL-20, (.020 inch thickness). This grade of laminate shall be counterbalanced.
 - 6. Backer: NEMA LD-3, Grade BK-20 (.020 inch thickness).
 - 7. Finishes, Colors and Patterns: As scheduled on Drawings, or as otherwise selected by Architect.

2.06 ACCESSORIES

- A. Adhesives:
 - 1. Laminate Adhesive: 3M Fastbond 30, or equivalent to suit application.
 - 2. Wall Panel Adhesive: Cartridge type compatible with paneling and wall substrate.
 - 3. Wood Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 4. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.
- B. Edge Trim for Plastic Laminate Casework: Moisture-curing reactive polyurethane hot melt adhesive (PUR) applied 1mm PVC banding with eased corner.
 - 1. Color shall be as selected by Architect from manufacturer's full range colors and finishes.
- C. Glass: As specified in Section 08 80 00.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application. Threaded steel for concealed joints.

2.07 HARDWARE

- A. Shelf Standards and Supports for Cabinet Mounted Shelving: K&V 255 standards and 256 supports.
- B. Shelf Standards and Brackets for Wall Mounted Shelving: Shelf standards and brackets with clips as scheduled on Drawings.

- C. Shelf Pin Supports for Cabinet Mounted Shelving: 32mm stainless steel shelf pins, or as otherwise indicated on Drawings or as approved by Architect.
- D. Drawer and Door Pulls: Stainless steel Trimco 562-4 or Stanley 4485, or as otherwise scheduled on Drawings or as approved by Architect.
- E. Drawer Slides: All drawer glides shall be Accuride 3017 full extension, 100 lb. capacity in all areas, unless otherwise indicated on Drawings.
 - 1. Finish: Clear zinc.
- F. Overlay Cabinet Hinges (5-knuckle): Stanley 1588 or Blum 91M 2550.
- G. Hinges: Other function hinges may be submitted for approval for special circumstances.
 - 1. Typical Door Hinges: ANSI-A156.9, B01612 – concealed hinge, self-closing with soft close, 120 to 125 degree of opening, full overlay type for screw attachment complete with mounting plates. Blum Clip Top m120 deg.+ with Add-On Blumotion Soft Close, or equal as manufactured by Grass www.grassusa.com, Salice www.saliceamerica.com, or Hettich www.hettich.com.
 - 2. Other function hinges may be submitted for approval for special circumstances.
- H. Sliding Door Track Assemblies: Johnson Hardware 1160 track and hanger set complete with track, hangers, track stops, bypass door guides, door stops, recessed pulls, and installation hardware.
- I. Sliding Door Pulls: Johnson Hardware 15US3.
- J. Locks: National C8138 for drawers; National C8123 for doors.
- K. Catches: Stanley 41 or K&V 43.
- L. Grommets: Doug Mockett & Company, Inc. www.mockett.com, size as indicated on Drawings.
 - 1. Color: As selected by Architect.
- M. Provide all other hardware as necessary to fulfill function of architectural woodwork and cabinets as shown on Drawings, subject to approval by Architect.
- N. Finish: Satin chrome and stainless steel as scheduled on Drawings, or as otherwise selected by Architect.

2.08 FABRICATION

- A. Fabricate architectural woodwork and cabinets in conformance with AWS Grade specified herein under "Quality Assurance."
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges of solid wood lumber to 1/16 inch radius, unless otherwise indicated on Drawings.
- D. Exposed fasteners are not allowed in the finish Work on exposed and semi-exposed surfaces.
- E. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

- F. Exposed Edges: Cap exposed edges of plastic laminate casework with moisture-curing reactive polyurethane hot melt adhesive (PUR) applied 1mm PVC banding with eased corners. Use one piece for full length only.
- G. Shelves: Fabricate shelves with 3/4 inch thick MDF, unless otherwise indicated.
 - 1. Laminate, Shelves within Casework: Melamine, thermally fused, at all shelf edges, unless otherwise indicated.
- H. Drill holes for shelf pin supports at 1 inch cent to center spacing. Locate shelf pin holes 3 inches from front and back of shelves.
- I. Drawer Boxes:
 - 1. Fabricate sides and back from minimum 1/2 inch (9-ply) plywood or melamine.
 - 2. Fabricate bottoms from minimum 3/8 inch (7-ply) plywood.
 - 3. Fabricate with dovetail joinery only and reinforce corners as necessary to prevent racking.
- J. Door and Drawer Fronts: 3/4 inch, or as shown on Drawings.
- K. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
- L. Semi-exposed Surfaces (Interior surfaces of plastic laminate casework): Melamine, thermally fused, unless otherwise indicated on Drawings.
- M. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing to walls.
- N. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arrises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- O. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces regardless of thickness or location.
- P. Provide cutouts, rough openings, and recesses for appliances, outlet boxes, lighting fixtures, plumbing components, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges. Extend J-boxes as required by NEC.
- Q. Hardwood Bench Seats: Fabricate to sizes and configurations indicated from solid hardwood glued plank tops in thickness indicated on Drawings. Coordinate with steel frame and legs specified in Section 05 50 00.
- R. Stainless Steel Countertops and Sinks: As specified in Section 12 31 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.03 INSTALLATION

- A. Set and secure cabinetry and other woodwork in place; rigid, plumb and level, and in accordance with applicable standard specified herein under "Quality Assurance" for grade of work specified.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Secure and align adjoining cabinet units and counter tops with concealed joint fasteners.
- E. Scribe casework abutting walls and other components, including walls with variable decorative finishes, with maximum gaps of 1/32 inch (0.80 inch). Do not use trim or additional overlay trim for this purpose.
- F. Secure cabinet and bases to floor using appropriate angles and anchorages.
- G. Exposed fasteners are not allowed in the finish Work except at field applied moldings and trim. When exposed fastening is required to complete installation, exposed fasteners shall be set in quirks, reveals, and reliefs (to be least visible when installation is complete). Fasteners in concealed locations shall be countersink and concealed with plugs to match surrounding materials; finish flush with surrounding surfaces.

3.04 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Water repellent coating for all exposed exterior CMU wall surfaces.

1.02 DEFINITIONS

- A. Water Repellent: Resistant to penetration of water from rainfall.

1.03 SYSTEM DESCRIPTION

- A. Water repellent shall penetrate into and chemically bond with substrate. Treated surface shall resist penetration by water and water-borne salts, ions, and other contaminants for the warranty period specified herein.
- B. Water repellent shall not change surface texture, appearance, or vapor permeability. Slight changes (darkening) of substrates after application are subject to approval by Architect prior to acceptance and general application.
- C. Masonry walls treated with water repellent shall show no evidence of moisture penetration when field quality control tested after application.

1.04 SUBMITTALS

- A. Submit sample of manufacturer's warranty and any special procedures required to obtain warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be able to show evidence that the firm has been engaged in producing such material for at least 5 years and that the product has maintained water repellency for over 5 years of continuous field exposure.
- B. Applicator Qualifications: Applicators shall be trained, approved and accepted by the Manufacturer and have a minimum of 2 years experience in successful application of water repellent products.
- C. Regulatory Requirements: Comply with volatile organic compound (VOC) regulations in effect within the jurisdiction of the Project site.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Delivery shall be made to the job site in Manufacturer's original containers with seals unbroken and labeled with Manufacturer's batch number.
- B. Storage and Protection: Store materials in original, unopened containers in compliance with Manufacturer's printed instructions and protect from damage.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements: Temperature and relative humidity conditions for a period before, during, and after application shall be as recommended by the Manufacturer. If rain occurs, allow surfaces to dry a minimum of 5 days.

1.08 WARRANTY

- A. Manufacturer shall provide a written warranty for a period of 5 years from date of project completion.
1. Written warranty shall include the following provisions:
 - a. Walls where water repellent has been applied shall show no evidence of moisture penetration on the interior surface of the wall for the full warranty period.
 - b. Coating will not cause changes in surface texture and color for the full warranty period, regardless of number of applications required to comply with performance requirements.
 2. Upon satisfactory completion of the installation, and as a condition of its acceptance, the warranty shall be delivered to the Owner.
 3. If at any time during the warranty period, any such failure occurs resulting from ordinary weather conditions in any area to which the coating has been properly applied, the manufacturer shall agree to supply all material needed to repair such affected areas at no additional cost.
- B. The applicator shall guarantee the installation against poor workmanship for a period of 2 years from the date of Substantial Completion. Applicator shall make necessary repairs without charge to Owner during that period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, subject to compliance with Specification requirements:
1. BASF Corporation Construction Chemicals www.master-builders-solutions.basf.us
 2. Euclid Chemical Company www.euclidchemical.com
 3. ProSoCo., Inc. www.prosoco.com
 4. Protectosil; Div. of Evonik Industries www.protectosil.com

2.02 MATERIALS

- A. Water Repellent Sealer:
1. Protectosil Aqua-Trete Concentrate, Protectosil.
 2. Barcade M.E or Weather-Guard, Euclid Chemical Company.
 3. Siloxane WB Concentrate, ProSoCo., Inc.
 4. MasterProtect H 400 (formerly Enviroseal 40), BASF.
 5. Equivalent penetrating siloxane, silene, or siloxane/silene blend for use on CMU masonry as approved by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
1. Carefully inspect the installed Work of other Trades, and verify that such Work is complete to the point where water repellent application may commence.
 2. The Manufacturer's representative shall verify that the water repellent can be applied in accordance with the Manufacturer's recommendations.
 3. Verify that cracks which exceed 1/64 inch (0.40mm) wide have been filled with pointing mortar or caulking material. Defective mortar joints shall be routed out, pointed with mortar and tooled.
 4. Verify that flashing and caulking materials have been installed properly.
 5. Verify that masonry has been cleaned as specified in Section 04 01 20.52.
 6. Verify sealants have been installed and are properly cured.
 7. Advise Architect in writing of unsatisfactory conditions. Do not apply water repellent until conditions have been corrected.

3.02 PREPARATION

- A. Protection:
1. Use all means necessary to protect clear water repellent before, during, and after installation and to protect the installed Work of other Trades.
 2. Metal, glass and other such items shall be protected by suitable masking materials to protect against overspray.
 3. In the event of damage, immediately make repairs and replacements necessary as acceptable to the Architect.
 4. Protect concrete sidewalks from runoff by soaking with water immediately prior to application on adjacent walls.
- B. Surface Preparation:
1. Allow walls to cure at least 30 days before clear water repellent is applied.
 2. Walls shall be free of excess mortar.
 3. Follow Manufacturer's instructions regarding allowable moisture level.
 4. Clean surface in accordance with water repellent manufacturer's recommendations to remove all loose and foreign matter that could interfere with application and performance of water repellent.

3.03 APPLICATION

- A. Water Repellent Application - General: Follow Manufacturer's instructions for application and coverage, and procedures established during pre-installation conference.
- B. Mixing:
1. Concentrates: Concentrated products shall be mixed as recommended by the manufacturer for type of substrate where applied.
 2. Strictly observe all mix ratios and consistently measure field mixes with containers calibrated in standard volume units.
- C. Surfaces to be coated:
1. All exposed exterior surfaces of concrete masonry unit walls, including surfaces not exposed to view but left exposed in the finished work such as backs of parapet walls, horizontal projections, etc.

2. Masonry surfaces indicated above which will be covered by another finish material such as metal wall panels, paint, etc., do not require application of water repellent.
3. Other locations as indicated on Drawings.

D. Application:

1. Apply water repellent to dry surfaces using airless spray equipment as recommended by the manufacturer at consistent minimum rate.
2. Apply product in saturating one or two coat application allowing time between coats as recommended by the manufacturer.
3. Apply product from bottom of the vertical surface to the top, saturating the surface until “run-down” is achieved, but avoiding excessive rundown in accordance with manufacturer’s printed instructions.
4. At no time shall rate of coverage be less than required by Manufacturer's written instructions and additional procedures established in the pre-installation conference.

- E. Protect surfaces where water repellent has been applied from rain, dirt, dust, traffic, wind-blown debris and other materials that could harm performance of material for a period of not less than 4 hours after application, but not less than protective time recommended by the manufacturer.

3.04 FIELD QUALITY CONTROL

A. Water Penetration Tests:

1. Twenty days after completion of this portion of the Work, and as a condition of its acceptance, demonstrate by running water test that the Work of this Section will successfully repel water.
2. Notify the Architect and Manufacturer at least 72 hours in advance and conduct the test in the presence of Architect and manufacturer's representative.
3. By means of an outrigger or similar acceptable equipment, place 3/4 inch garden hose with garden type spray nozzle, at a point designated by the Architect, 8 feet to 10 feet away from the wall, aiming the nozzle so that water will strike the wall at a 45 degree downward angle.
4. Run the water onto the wall at full available force for not less than 4 hours. Provisions shall be made to collect the run off water into a container, and if possible to reuse it in the test
5. Upon completion of the four hour period, inspect the interior surface of the wall for evidence of moisture penetration.
6. If evidence of moisture penetration is discovered, perform corrective procedures recommended by the manufacturer and as established during the pre-installation conference to the areas where leakage occurred.
7. Successful application of water repellent will show no evidence of moisture penetration on the interior surface of the wall after four hour period.
8. An additional area or areas designated by the Architect shall be tested and corrected if leakage occurs, at no additional cost to Owner.
9. Application of water repellent is subject to rejection upon failing field quality control testing after corrective procedures have been performed at areas failing initial field quality control testing.

3.05 CLEANING

- A. Clean spillage and overspray as recommended by the Manufacturer.
- B. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of away from premises.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Batt/Blanket thermal building insulation.
 - 2. Rigid board wall insulation installed at interior furred CMU walls as indicated on Drawings.
 - 3. Fire-safing insulation.
- B. Related Sections:
 - 1. Section 07 84 00 – Firestopping.
 - 2. Section 09 81 00 – Acoustical Insulation, for sound attenuation insulation.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's data, installation instructions, limitations and recommendations. Include certification and test data substantiating R-Values and combustibility of each type of insulation.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Provide certificate of compliance acceptable to authorities having jurisdiction indicating conformance to fire-resistance requirements.
- C. Fire safing insulation and assemblies for closure of various voids with fire safing insulation shall comply with IBC Chapter 7 requirements.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage: Deliver materials to job in Manufacturer's original unopened packaging. Adequately protect against damage while stored at the site. Deliver so that stocks of materials on the site will permit uninterrupted progress of the Work.
- B. Materials shall be properly identified on each package with the Manufacturer's name and R value.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements:
 - 1. Batt and Semi-Rigid Batt Insulation:
 - a. Johns-Manville www.jm.com
 - b. Owens-Corning Fiberglas Corp. www.owenscorning.com
 - c. CertainTeed Corp., Saint Gobain www.certainteed.com
 - d. Knauf Insulation www.knaufinsulation.com

2. Board Insulation:
 - a. The Dow Chemical Co. www.dow.com/styrofoam/na/
 - b. Amoco Foam Products Co. www.bp.com/chemicals/who/units
 3. Fire Safing Insulation:
 - a. Thermafiber, Inc. www.thermafiber.com
 - b. Roxul Inc. www.roxul.com
- B. Materials designated for a specific application shall be the products of one Manufacturer.

2.02 MATERIALS

- A. Batt Insulation:
1. Unfaced Glass Fiber Batts: ASTM C665, Type I, unfaced glass fiber batts.
 2. Provide ASTM C553, Type I, unfaced mineral fiber batts manufactured from mineral fiber where used within walls with cement backer board applied to one or both sides or where indicated to be used within shaft wall construction.
 3. Provide batts manufactured from mineral fiber where used within walls with cement backer board applied to one or both sides.
 4. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively when tested in accordance with ASTM E84.
 5. Thickness: Provide minimum thickness as indicated on Drawings for various locations, or minimum thickness to provide the resistance values indicated on Drawings, for various locations. Batts shall be a single thickness to meet the required R value, multiple layers of batts will not be accepted.
- B. Rigid Board Insulation: Polyisocyanurate board insulation complying with ASTM C1289, Type I, Class 1 or 2, 25 psi minimum, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, based on unfaced core on thickness up to 4 inches.
1. Thickness: As indicated on Drawings.
 2. Adhesive: Dow Insta-Stic, single component, moisture cured, polyurethane insulation adhesive as manufactured by Dow Chemical Company.
 3. Furring Channels: Refer to Section 07 46 46 for installation of metal furring channels installed as part of installation of fiber cement board and batten siding.
- C. Fire Safing Insulation: ASTM C24, E119 and E136, with 4 pcf density. Thickness shall be as required by the Manufacturer to provide a fire rating equal to that of the assembly of which it is a part.
- D. Acoustical Batt Insulation: Sound attenuation batt insulation as specified in Section 09 81 00.
- E. Spindle Anchors, Washers and Shields: Provide copper coated low carbon steel spindles, angled type where required for attachment, with steel insulation retainer plates, washers and shields that are listed and labeled for use. Protect ends of spindles with capped self-locking washers where exposed to contact.
1. Acceptable Products:
 - a. Stic-Klip Mfg. Co., Type A or B as necessary, with Type S adhesive
 - b. Miracle Adhesive Corp. "Miracle StukUps" with Type HT994 adhesive.
 - c. Goodloe E. Moore Gemco Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable.
- F. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- G. Safing Clips: Galvanized steel safing clips approved by Manufacturer of safing insulation for holding safing insulation in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Comply with manufacturer's installation instructions and ASTM C1320.
- B. Batt Insulation:
 - 1. Delay installation until Construction has progressed to the point that inclement weather will not damage or wet the insulation material.
 - 2. Friction-fit blanket insulation in place. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.
 - 3. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such use.
 - 4. Fully insulate small areas between closely spaced framing members, pipes, conduits or other obstruction by cutting and fitting insulation material as required to maintain the integrity of the insulation. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.
 - 5. Installation of insulation of scheduled thickness / R-value is required at all exterior walls, soffits, underside of roofs where indicated, projections, etc., whether indicated on Drawings or not.
 - 6. At metal framing, support unfaced blankets mechanically.
 - a. Secure batt insulation to underside of roof sheathing with wire.
 - 7. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.
 - 8. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation. End match neatly with ends fitting snugly.
 - 9. Place insulation tight to exterior wall or roof substrate without airspace between insulation and exterior sheathing or roof substrate.
 - 10. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 11. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts or misalignments in membrane.

- B. Rigid Board Insulation:
 - 1. Install board insulation between furring members at interior side of exterior walls at locations indicated on Drawings.
 - 2. Insulate small areas between closely spaced framing members, pipe, conduit or other obstructions by cutting and fitting insulation materials as required to maintain the integrity of the insulation.
 - 3. Fit ends snugly.
- C. Fire Safing Insulation: Install in proper sizes on safing clips as needed but not to exceed 24 inches O.C. Leave no voids between walls and edges of slabs.
 - 1. Install safing clips where required to support insulation as required by Code.
 - 2. Cut safing insulation 1/2-inch wider than gap to be filled to ensure compression fit. Leave no voids in completed installation.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.
- B. Protection: Take precautions to protect insulation, both during and after installation, from damage of any kind until covered.

END OF SECTION

SECTION 07 24 13

TEXTURED ACRYLIC FINISHING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes the following:
 - 1. Textured Acrylic ICF Finish System installed over fluid-applied, vapor permeable air barrier membrane system specified in Section 07 27 26, over Insulating Concrete Form (ICF) wall construction.
 - 2. Textured Acrylic ICF Finish System and rigid insulation board installed over fluid-applied, vapor permeable air barrier membrane system specified in Section 07 27 26, over exterior plywood wall sheathing.
 - 3. Textured Acrylic ICF Finish System installed over exterior gypsum sheathing at soffit locations.
 - 4. Other conditions indicated on Drawings.
- B. Related Sections:
 - 1. Section 03 11 19 - Insulating Concrete Forms, for ICF wall construction.
 - 2. Section 04 22 00 – Concrete Unit Masonry, for CMU wall construction.
 - 3. Section 06 10 00 – Rough Carpentry, for exterior plywood sheathing and wall framing.
 - 4. Section 07 27 26 – Fluid-Applied Vapor Permeable Air Barrier Membrane.

1.02 REFERENCES

- A. ASTM B117 (Federal Test Standard 141A Method 6061) Test Method of Salt Spray (Fog) Testing.
- B. ASTM C150 Specification for Portland Cement.
- C. ASTM C297 Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane.
- D. ASTM D968 (Federal Test Standard 141A Method 6191) Test Method for Abrasion Resistance of Organic Coatings by Falling Abrasive.
- E. ASTM D3273 Test Method for Resistance to Growth of Mold on Surfaces.
- F. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E96 Test Method for Water Vapor Transmission of Materials.
- H. ASTM G155 (ASTM G23 or G26) Recommended Practice for Operating Exposure Apparatus (Carbon-Arc Type) With and Without Water, for Exposure of Nonmetallic Materials.

1.03 DESCRIPTION

- A. General: Acrylic Finish System for ICF walls is a TAFS consisting of base coat, reinforcing mesh and finish.

- B. Design Requirements:
1. Acceptable surfaces for the ICF Finish System include ICF consisting of molded EPS manufactured with buried webs and ICF with exposed webs when additional EPS is applied to the ICF surface.
 2. Projecting surfaces shall have a minimum slope of 6:12 and maximum length of 305 mm (12 in).
 3. The substrate shall be flat and smooth.
 4. The specified ICF shall comply with all applicable code requirements for the construction type (combustible or non-combustible). Details shall conform with proper termination requirements for combustible or non-combustible construction (refer to published details).
- C. Performance Requirements: As a minimum the Dryvit materials shall be tested as follows:
1. Mildew/Fungus Resistance: ASTM D3273; Passed
 2. Accelerated Weathering: ASTM G155 - 5000 hrs.; Passed
 3. Salt Spray Resistance: ASTM B117 – 300 hrs.; Passed
 4. Abrasion Resistance: ASTM D968; Passed
 5. Absorption, Freeze/Thaw: ASTM C67 – 60 Cycles; Passed
 6. Water Penetration: ASTM E331; Passed
 7. Flame Spread: ASTM E84 – Flame Spread Index less than 25, Smoke Developed less than 450.
 8. Impact Resistance: EIMA 101.86. Impact resistance is measured over EPS insulation and varies with the specific reinforcing mesh used. Refer to table below:

Reinforcing Mesh/Weight g/m ² (oz/yd ²)	EIMA Impact Classification	EIMA Impact Range		Impact Test Results	
		Joules	(in-lbs)	Joules	(in-lbs)
Standard - 146 (4.3)	Level 1	3-6	(25-49)	4	(36)
Standard Plus - 203 (6)	Level 2	6-10	(50-89)	6	(56)
Intermediate - 407 (12)	Level 3	10-17	(90-150)	12	(108)
Panzer 15* - 509 (15)	Level 4	>17	(>150)	18	(162)
Panzer 20* - 695 (20.5)	Level 4	>17	(>150)	40	(352)
Detail Short Rolls - 146 (4.3)	n/a	n/a	n/a	n/a	n/a
Corner Mesh - 244 (7.2)	n/a	n/a	n/a	n/a	n/a
*Shall be used in conjunction with Standard Mesh					

9. Water Vapor Transmission: ASTM E96 – Vapor Permeable

1.04 SUBMITTALS

- A. Product Data: Submit product data sheets describing products, which will be used on this project.
- B. Samples: Submit two (2) samples of each finish, texture, and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used to prepare the samples. Samples shall be of sufficient size to accurately represent each color and texture to be utilized on the project.

1.05 QUALITY ASSURANCE

- A. Qualifications
 - 1. Materials shall be manufactured at a facility covered by a current ISO 9001:2000 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).
 - 2. Installer: Shall be knowledgeable in the installation of the specified materials and shall be experienced and competent in the application of TAFS. Additionally the contractor shall possess a current trained contractor certificate from the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be delivered to the job site in the original, unopened packages with labels intact.
- B. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.
- C. Materials shall be stored at the job site in a cool, dry location, out of direct sunlight, protected from weather and other damage.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements
 - 1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are dry.
 - 2. At the time of application, the air and wall surface temperatures shall be minimum as recommended by manufacturer. Temperatures shall be maintained, with adequate air ventilation and circulation, for a minimum of 24 hours thereafter, or until the products are dry.

1.08 SEQUENCING AND SCHEDULING

- A. Installation of the ICF Finish System shall be coordinated with other construction trades.
- B. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.09 LIMITED MATERIALS WARRANTY

- A. Manufacturer shall provide its standard written warranty against defective materials.

PART PRODUCT

2.01 MANUFACTURER

- A. Products equaling or exceeding quality requirements of the specified product, of the following manufacturers, as follows or as approved are acceptable for bidding:
 - 1. Dryvit System, Inc., West Warwick, RI www.dryvit.com
 - 4. Senergy, Inc., Cranston RI www.senergy.cc
 - 5. STO Industries, Rutland, VT. www.stocorp.com

- B. Basis of Design: Specification is based on products by Dryvit Systems, Inc.

2.02 MATERIALS

- A. Portland Cement: shall be Type I, I-II or II, meeting ASTM C150, white or gray in color, fresh and free of lumps.
- B. Water: Shall be clean and free of foreign matter.

2.03 COMPONENTS

- A. Weather Barrier (at openings and penetrations).
 1. Dryvit Backstop NT™: A fully formulated, non-cementitious, water based material.
 2. Dryvit Grid Tape™: A 100 mm (4") wide, open weave fiberglass mesh tape.
 3. Dryvit Flashing Tape™: A high density, polyethylene backed, tape with a rubberized asphalt adhesive.
 4. Dryvit Flashing Tape Surface Conditioner™: A water-based surface conditioner and adhesion promoter for the Dryvit Flashing Tape.
- B. Insulation Board: Expanded polystyrene, ASTM C578, Type I, aged (air dried) for 6 weeks at 68 degrees F. minimum, or for 5 days at 140 degrees F. before use.
 1. Flame Spread (ASTM E84 or UL 723): Less than 25.
 2. Smoke Developed: 450 Max.
 3. Average Density: 1.0 pound per cubic foot.
 4. K-value: 0.27 (R-3.6) per inch.
 5. Thickness: As indicated on Drawings, 1 inch minimum.
 6. Provide decorative shapes of size and profile indicated on Drawings.
- C. Base Coat/Adhesive
 1. Cementitious: A liquid polymer based material, which is field-mixed in a 1:1 ratio by weight with Portland Cement.
 - a. Shall be Genesis® or Primus®.
 2. Ready mixed: A dry blend cementitious, co-polymer based product, field mixed with water.
 - a. Shall be Genesis DM™, Primus DM™ or Rapidry DM™.
 3. Water Resistant: A high percentage polymer-blend material, which is field mixed with Portland Cement in a 1:1 ratio by weight.
 - a. Shall be Dryflex®.
 4. Dryvit AP Adhesive (adhesive only): A moisture cure one-part urethane-based product.
- D. Reinforcing Mesh(es): Shall be a balanced open weave, glass fiber fabric treated for compatibility with other System materials and shall be as noted in Paragraph 1.04.C.8 above.
- E. Finishes: Integral color finish of type, color, and texture as indicated on the Drawings or as otherwise selected by Architect.
- F. Coatings, Primers and Sealers: As appropriate to the system as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to application of the ICF Finish System, the Contractor shall ensure that the substrate is suitable for application.
- B. Prior to the installation of the ICF Finish System, insure that all needed flashings and other waterproofing details have been completed, if such completion is required.
- C. Work shall not proceed until discrepancies have been corrected.

3.02 SURFACE PREPARATION

- A. The substrate shall be free of foreign materials such as dust, dirt, moisture, frost and any other materials that inhibit adhesion.
 - 1. The surface of the ICF or EPS layer shall be prepared as to be flat and smooth.
 - 2. The entire surface of the ICF or EPS layer shall be rasped to remove any UV degradation and provide a smooth planar surface.
 - 3. All voids and gaps greater than 1.6 mm (1/16 in) in the ICF or EPS layer shall be slivered and filled using additional pieces of insulation. Note: base coat material shall not be used for leveling. The wall surface must be brought into plane prior to applying coatings.
 - 4. Where required, provision shall be made for termite control and inspections along the base of the wall. Consult ICF manufacturer regarding proper treatment at grade.

3.03 INSTALLATION

- A. The materials shall be mixed and applied in accordance with manufacturer's current printed application instructions.
 - 1. Install additional layer of EPS insulation board when specified:
 - a. To face of molded ICF (if applicable) using adhesive per or mechanical fasteners anchored in attachment strips in the ICF to satisfy structural requirements.
 - b. To face of extruded ICF (required) using mechanical fasteners anchored in attachment strips in the ICF to satisfy structural requirements.
 - 2. Apply edge wrap using Detail reinforcing mesh embedded in base coat at all ICF and EPS terminations.
 - 3. Install all EPS trim by adhering to the existing ICF using adhesive and allow to dry.
 - 4. Apply a layer of the specified reinforcing mesh embedded in wet base coat mixture over the entire wall surface area and trowel smooth. The recommended method is to apply the base coat in two passes.
 - 5. Allow the base coat mixture to cure a minimum of 24 hours until completely dry. Cool, humid conditions may require longer cure times.
 - 6. Apply the specified finish in accordance with manufacturer's printed installation instructions.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: During construction the work shall be inspected by the EIFS manufacturer or authorized representative.

3.05 CLEANING

- A. All excess materials shall be removed from the job site.

- B. All surrounding areas, where coatings have been installed, shall be left free of debris and foreign substances resulting from the work.

3.06 PROTECTION

- A. Protect from damage and exposure to dust and other contaminants until dry.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED VAPOR PERMEABLE AIR BARRIER MEMBRANE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Fluid-applied, vapor permeable air barrier membrane system, including materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, exterior cladding material attachments and ties, piping and other penetrations through the wall assembly.
- B. Related Sections:
 - 1. Section 03 11 19 - Insulating Concrete Forms, for ICF wall construction to receive fluid-applied membrane air and vapor barrier membrane.
 - 2. Section 04 22 00 – Concrete Unit Masonry, for CMU walls to receive fluid-applied membrane air and vapor barrier membrane.
 - 3. Section 06 10 00 – Rough Carpentry, for exterior plywood sheathing and wall framing.
 - 4. Section 07 24 13 – Textured Acrylic Finish System, for textured acrylic finish system applied over fluid-applied membrane air and vapor barrier membrane.

1.02 DEFINITIONS

- A. Vapor Permeable Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.
- B. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- C. Building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. The air barrier shall have the following characteristics:
 - 1. It shall be continuous, with all joints made airtight.
 - 2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf), when tested in accordance with ASTM E2178.
 - 3. It shall have an air permeability not to exceed 0.04 cfm/sq. ft. under a pressure differential of 0.3 in. water, when tested in accordance with ASTM E2357.
 - 4. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.

5. It shall be durable or maintainable.
6. Air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - a. Foundation and walls
 - b. Walls and windows or doors
 - c. Different wall systems
 - d. Wall and roof
 - e. Wall and roof over unconditioned space
 - f. Walls, floor and roof across construction, control and expansion joints
 - g. Walls, floors and roof to utility, pipe and duct penetrations
7. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.04 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 1. Include details of interfaces with other materials that form part of air barrier.
 2. Include details of mockups.
- C. Samples: Submit representative samples of the following for approval:
 1. Fluid-applied membrane.
 2. Transition membrane and other components of membrane system.
- D. Certificates: Submit product certificates for air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- F. Qualification Data: For applicator.
- G. Product Test Reports:
 1. Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 10 years experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Source Limitations: Components used shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives.
- C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, to a minimum of 5 projects, whose work has resulted in applications with minimum of 10 years history of successful in-service performance.

- D. Single-Source Responsibility: Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.
- E. Provide products which comply with all federal, state and local regulations controlling use of volatile organic compounds (VOCs).
- F. Preinstallation Conference: Conduct conference at Project site.
 - 1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed aluminum window wall and storefront systems, and door frames.
 - 2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.06 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency. Coordinate mockups with exterior finish materials.
 - 1. Adhesion Testing: Mockups will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D4541.
 - 2. Test mock-up for air and water infiltration to conform with Section 01 45 00 - Quality Control, in accordance with ASTM E 783 and ASTM E 1105.
 - 3. Notify Architect 7 days in advance of the dates and times when mockups will be tested.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.
- B. Storage and Handling: Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets.
 - 1. Protect from damage from sunlight, weather, excessive temperatures and construction operations.
 - 2. Store roll materials on end in original packaging. Protect rolls from direct sunlight until ready for use.
 - 3. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees F and rising.
 - 4. Keep solvent away from open flame or excessive heat.
 - 5. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.08 PROJECT/SITE CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.09 COORDINATION

- A. Ensure continuity of the air barrier throughout the scope of this section.

1.10 WARRANTY

- A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to maintain specified air permeance rating.
 - b. Failure to maintain specified vapor permeance rating.
 - 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as otherwise approved by the Architect, subject to compliance with specifications requirements:
 - 1. Henry Company www.henry.com
 - 2. Grace Construction (W.R. grace & Co.-Conn.) www.graceconstruction.com
- B. Basis of Design: Air-Bloc 31MR as manufactured by Henry Company

2.02 MATERIALS

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier:
 - 1. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf); when tested per ASTM E2178.
 - b. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/sq. ft. of surface area under pressure differential of 0.3 in. water (1.57 psf) when tested in accordance with ASTM E2357.
 - c. Water Vapor Permeance: Greater than 10 perms; when tested in accordance with ASTM E96, Method B.
 - d. Pull Adhesion: Minimum 20 psi or substrate failure to glass faced wall board, minimum 100 psi to concrete/CMU; when tested in accordance with ASTM D4541.
 - e. Low temperature flexibility: Pass at minus 20 degrees F. per ASTM D1970.
 - f. Water resistance of in-place membrane: Pass. No water penetration after 90 minutes @ 6.24 psf tested over OSB and gypsum sheathing in accordance with ASTM E331.

- g. Nail sealability: Pass UV Exposure Limit: Equal to or greater than 180 calendar days when tested in accordance with ASTM D1970.
- h. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly
- 2. Acceptable Products: Subject to compliance with requirements, provide products as manufactured by one of the following:
 - a. Air-Bloc 31MR; Henry Company (Basis of Design)
 - b. Perm-A-Barrier VPL, Grace Construction.

2.03 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.
- C. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- D. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- E. Wall Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
 - 1. Flash Point: No flash to boiling point.
 - 2. Solvent type: Water.
 - 3. VOC Content: Not to exceed 10 g/l.
 - 4. Application Temperature: 25 deg. F and above.
 - 5. Freezing Point (as packaged): 21 deg. F.
- F. Flexible Membrane Flashing/transition Membrane: Membrane: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Joint Sealant: As specified in Section 07 92 00 – Joint Sealers. Verify compatibility of sealants with membrane prior to commencing work.
- I. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- J. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- K. Insulation Adhesive: Manufacturer's standard synthetic, trowel applied, rubber based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat board joints with manufacturer's recommended 50-75mm (2-3 in.) wide self-adhesive tape. Gaps greater than 1/4 inch should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier system.
- C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.
- D. ICF Wall Construction: Comply with recommendations of the fluid-applied membrane air and vapor barrier manufacturer for preparation of ICF wall construction.
- E. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- F. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- G. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- H. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- I. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- J. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- K. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

- L. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

- A. Joint Treatment: Seal joints up to 1/2 inch and less between panels of exterior grade gypsum sheathing, plywood, OSB or cementitious panels with joint treatment sealant.
 - 1. Fill joint between sheathing with approved joint treatment sealant ensuring contact with all edges of sheathing board. Strike flush any excess sealant over joint layer to form a continuous layer over the joint.
 - 2. Alternatively, seal gaps and voids or irregular joints greater than 1/4 inch between panels of exterior grade gypsum, exterior gypsum sheathing, plywood, OSB or cementitious panels with a strip of self-adhering air/vapor barrier transition membrane lapped a minimum of 1-1/2 inches on both sides of the joint.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.
 - 3. Alternately, joints not exceeding 1/8 inch can be sealed with yellow open weave glass fabric.
 - a. Apply yellow open weave glass fabric centered over joint followed by a 1/8 inch thick trowel application of air/vapor barrier membrane.
 - b. Allow to dry prior to application of primary vapor permeable air barrier membrane.
- B. Inside and Outside Corners:
 - 1. Seal inside and outside corners of sheathing boards with a strip of self-adhering transition membrane extending a minimum of 3 inches on either side of the corner detail.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.
- C. Crack treatment – Masonry and Concrete:
 - 1. Seal cracks over 1/16 inches in masonry and concrete with a strip of self-adhering transition membrane lapped a minimum of 1 1/2 inches on both sides of the crack.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.
 - 2. Alternately, static cracks 1/16 inch to 1/8 inch can be sealed with primary air barrier membrane.
 - a. Fill crack with primary air barrier membrane.
 - b. Allow to dry prior to application of primary vapor permeable air barrier membrane.

3.04 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate installation of air with installation of adjacent construction to ensure continuity of air barrier assembly.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier (where applicable), concrete below-grade structures, floor-to-floor construction, exterior glazing and window wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, aluminum framed window wall and storefront assemblies, and doors. Apply modified bituminous transition strip, elastomeric flashing sheet or preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Transition Strips and Membranes: Roll firmly to enhance adhesion.
 - 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
- G. Fill gaps in perimeter frame surfaces of windows, aluminum framed window wall and storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and similar penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous or counterflashing strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.05 FLUID AIR AND WATER BARRIER INSTALLATION

- A. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- B. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding Membrane Air Barrier: Minimum thickness as required by manufacturer to achieve minimum performance, but not less than 90 mil wet film thickness, 45 mil dry film thickness.
- D. Apply strip and transition strip over cured air-barrier material overlapping as recommended by membrane manufacturer onto each surface according to air-barrier manufacturer's written instructions.
- E. Do not cover air barrier until it has been tested and inspected by Owner's testing agency, if required.
- F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.06 FIELD QUALITY CONTROL

- A. Test Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Surfaces have been primed, if applicable.
 - 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 8. Termination mastic has been applied on cut edges.
 - 9. Strips and transition strips have been firmly adhered to substrate.
 - 10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Remove and replace deficient air barrier components and retest as specified above.

3.07 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.
 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.
- D. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 07 32 16
CONCRETE ROOFING TILES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Concrete roofing tiles and installation materials, including roof underlayment.

1.02 DESIGN REQUIREMENTS

- A. Performance: Concrete roofing tile materials and installation shall comply with requirements of the 2012 IBC.
- B. Roofing tile materials and installation shall conform to the requirements of ICC ESR 1900 and LA RR 25021, and the latest edition of the Concrete and Clay Roof Tile Installation Manual.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each material and product used, including the following:
 - 1. Preparation instructions and recommendations.
 - 2. Installation instructions and recommendations.
 - 3. List of accessories.
 - 4. Current ICC Report.
 - 5. Storage and handling requirements and recommendations.
- B. Shop Drawings: Submit shop drawings showing details on hip, ridge, valley and gable configurations, methods of fastening and attachment, and collaborated details with related work. Include a calculation of the total weight of materials to be installed as a roofing system.
- C. Samples: Submit samples showing color, surface finish and texture, and configuration.
- D. Certificates of Compliance showing compliance with referenced standards.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer shall be a member of the Tile Roofing Institute.
 - 2. Work shall be performed by a licensed roof tile contractor approved by the manufacturer.
- B. Perform work in conformance with the following:
 - 1. Concrete and Clay Roof Tile Installation Manual (TRI Installation Manual) published July 2015, Uniform ES ER-2015, by the Tile Roofing Institute & Western States Roofing Contractors Association www.tilerroofing.org
 - 2. Latest edition of the National Roofing Contractors Association (NRCA), Steep Roofing Manual.

- C. Regulatory Requirements: Provide extruded concrete roof tile approved for use by ICC as described in current ICC Research Committee Report.
- D. Mock-ups: Provide mock-up as follows if requested by Architect:
 - 1. Construct sample roof panel, minimum 8 feet square, matching roof pitch of Project showing proposed color blend, random stacking and mud setting to be used on the Project using the identical materials and installation which will be used on the remainder of the Project.
 - 2. The purpose of this sample will be to observe color blend and aesthetic effect, the method of installation, including workmanship.
 - 3. The sample, when approved by the Architect, will function as a reference base for acceptance or rejection of color, random stacking, and mud setting.
 - 4. Approved Mock-up may remain as part of finished construction.

1.05 DELIVERY, HANDLING AND STORAGE

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.
- B. Handling:
 - 1. Comply with manufacturer's instructions.
 - 2. To avoid the occurrence of color patterning on the roof, tiles shall be loaded from different pallets to ensure that shades are either segregated or blended uniformly over the entire roof elevation.
 - 3. Refer to roof loading guide of the Concrete and Clay Roof Tile Installation Manual (TRI Guide) published July 2015, Uniform ES ER-2015.
- C. Storage:
 - 1. Adequately protect against damage while stored at the site and protect from mud, dust, dirt or other materials likely to stain or render tile unsatisfactory for installation.
 - 2. Do not stack loaded pallets on top of one another.
 - 3. Do not stack tiles on roof in a manner which would endanger structure.
 - 4. Distribute stacks of tile uniformly in accordance with manufacturer's printed instructions.

1.06 PROJECT CONDITIONS

- A. Anticipate environmental conditions (temperature, humidity, and ventilation) to schedule work within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install underlayment on wet or frozen sheathing.
- C. Do not begin installation until related work in areas to receive tiles is complete.

1.07 WARRANTY

- A. Manufacturer shall warrant the products against manufacturing defects and shall include material and labor to repair or replace defective materials as specified in manufacturer's warranty.
 - 1. Warranty Period - Concrete Roof Tile: Lifetime Transferable Limited Product Warranty for concrete roof tile.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the specified Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 - 1. Eagle Roofing Products www.eagleroofing.com
 - 2. Boral Roofing www.boralamerica.com
- B. Basis of Design: Drawings and Specifications are based on products as manufactured by Eagle Roofing Products.

2.02 TILE MATERIALS

- A. Concrete Tile:
 - 1. Profile: Capistrano High Profile as manufactured by Eagle Roofing Products, or as otherwise indicated on Drawings.
 - 2. Color/Finish: As scheduled on Drawings or as otherwise selected by Architect from manufacturer's full line of available colors.
 - 3. Trim Tile and Hip Starters: Barrel type.
 - 4. Design:
 - a. Interlocking, with anchor lugs located on the underside.
 - b. Interlocking ridges shall be provided on the longitudinal edges to restrict lateral movement and provide waterstop.
 - c. Transverse bars on underside to serve as weather checks.
 - d. One or two nail holes depending on profile.
 - 5. Composition: Extruded cured concrete composed of Portland Cement and selected sand aggregate being colored by integral color addition or surface coating of specially formulated Portland Cement based products and coloring agents.

2.03 INSULATION AND COVER BOARD

- A. Roof Insulation: Polyisocyanurate insulation with glass fiber facers conforming to ASTM C1289, Type II, Class 1.
 - 1. Compressive Strength (ASTM D1621): 20 psi.
 - 2. Nominal Overall Density (ASTM D1622): 2 pcf.
 - 3. Dimensional Stability (ASTM D2126): Less than 2 percent.
 - 4. Moisture Vapor Transmission (ASTM E96): Less than 1 perm.
 - 5. Maximum Flame Spread (E84): 75.
- B. Insulation Cover Board: Dens-Deck Prime, glass-mat faced, water-resistant gypsum substrate board complying with ASTM C1177 as manufactured by Georgia Pacific Corporation.
 - 1. Thickness: 1/2 inch.
 - 2. Cover Board Fasteners: Size and type as recommended by manufacturer for type of substrate and as required to comply with wind uplift requirements.

2.04 SHEET MATERIALS

- A. Underlayment: ASTM D226, No. 30 unperforated asphalt saturated felts (2-layers).

- B. Self-Adhering, High-Temperature, Butyl-Based Flashing Membrane: 30 to 40 mils thick minimum, consisting of slip-resisting polyethylene film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing, cold applied. Provide primer and protection sheet when recommended by underlayment manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grace Ultra.
 - b. Carlisle Coatings & Waterproofing, Inc. Dri-Start HR.
 - c. Henry Company; Perma-Seal PE.
 2. Underlayment Primer: As recommended by the manufacturer of the underlayment material.

2.05 ACCESSORIES

- A. Tile Fasteners:
1. Nails: Corrosive resistant fastener meeting ASTM A641 Class I or approved equal. Number 11 gauge diameter and of sufficient length to penetrate 3/4 inch into or through the thickness of the deck or the batten. Comply with the TRI Installation Manual.
 2. Screw Fasteners: Corrosion resistant meeting ASTM A641 Class 1 and/or corrosion resistance equal (according to ASTM B 117).
 - a. Screws shall be 2-1/2 inches in length or penetrate a minimum 3/4 inch into the deck or batten.
 - b. ASTM A641 Class 1 is a nail specification that can be converted to screw fasteners through performance testing (ASTM B 117).
 - c. Each fastener manufacturer is responsible for supplying this support this data. Minimum #8 course thread.
- B. Plastic Cement: ASTM D4586; Type 2, asphalt type with mineral fiber components, free of toxic solvents, capable of setting within 24 hours at temperatures of 75 degrees F. and 50 percent RH.
- C. Deck Tape: 2 inch wide aluminum coated cloth duct tape with adhesive backing.
- D. Plastic Battens: 1/2 inch x 1-5/8 inch x 48" lengths corrugated 100% polypropylene battens as manufactured by Battens Plus, Inc. www.battensplus.com
1. Comply with TRI Guide - Concrete and Clay Roof Tile Installation Manual Fourth Edition.
- E. Eave Closure/Riser/Bird Stop:
1. Comply with TRI Guide Fourth Edition installation Guide and Drawings.
 2. Eagle Roofing Products Bird Stop Capistrano/High Profile - Terracotta, Color as selected by Architect.
- F. Ridge Weather Block for High Profile Tiles: Terracotta, Black color.
- G. Mortar:
1. One part ASTM C150 Type 1 Portland Cement, 2 parts uniformly graded, clean sand conforming to ASTM C144, and potable water as required to provide workable mix.
 2. Plasticizer may be added if required, to assist workability.
 3. Color: Integral colored synthetic mineral oxide color as selected by Architect and/or Owner.
- H. Tile Adhesive: Tile adhesive formulated for use with concrete roofing tile as recommended by roof tile manufacturer.

2.06 FLASHING MATERIALS

- A. Sheet Flashing:
 - 1. Galvanized Steel: ASTM A653, 24 gauge minimum and as indicated, with G-90 coating.
 - 2. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14.
 - 3. Finish: Full strength Kynar 500/Hylar 5000 Fluorocarbon coating, applied by the Manufacturer on a continuous coil coating line, with top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil.
 - a. Bottom side: Coated with primer with a dry film thickness of 0.25 mil.
 - b. Finish: Conform to all tests for adhesion flexibility, and longevity as specified by the Kynar 500 finish supplier.
 - c. Color: Color as selected by Architect.
- B. Bituminous Paint: Acid and alkali resistant type; black color.
- C. Flashing Nails: Aluminum, standard round wire roofing type, with prefinished heads matching color of flashing; of sufficient length to penetrate through roof sheathing.

2.07 MORTAR MIXES

- A. Mortar: One part ASTM C150 Type 1 Portland Cement, 2 parts uniformly graded, clean sand conforming to ASTM C144, and potable water as required to provide workable mix.
 - 1. Plasticizer may be added if required, to assist workability.

2.08 FLASHING FABRICATION

- A. Form flashings to profiles required and as may be indicated on Drawings, and to protect materials from physical damage and shed water.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
- C. Hem exposed edges of flashings minimum 1/4 inch on underside.
- D. Apply bituminous paint on concealed surfaces of flashings.
- E. Rake and Ridge Flashing: Raised Metal Rake Trim for All Profiles, 1-1/2 inches.
- F. Valley Flashings:
 - 1. No. 26 Gauge (G90) Galvanized 24 inches Flashing.
 - 2. Comply with the TRI Installation Manual, Appendix A for valley flashings.
- G. Wall Trays (Pans) Flashing:
 - 1. No. 26 Gauge (G90) Galvanized minimum 6 inches trough.
 - 2. Comply with the TRI Installation Manual, Appendix A for wall/pan flashings.
- H. Pipe Flashing: No. 26 Gauge (G90) Galvanized deck flashing installed with underlayment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive tile to verify:
 - 1. Surfaces are uniform, smooth, sound, clean and free of irregularities.
 - 2. Related work penetrating the plane of the roof is completed.
 - a. Roof openings are correctly framed.
 - b. Roof penetrations are in place and flashed to deck surface.
 - 3. Verify that deck is of sufficient thickness to accept fasteners
- B. Do not commence tile installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Seal roof deck joints wider than 1/16 inch with deck tape.
- B. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
- C. Broom clean deck surfaces.

3.03 INSULATION AND COVER BOARD INSTALLATION

- A. General: Install rigid roof insulation and cover board at metal roof deck areas indicated on Drawings to be installed with rigid insulation above the deck.
- B. Insulation: Install insulation complete and ready for roofing. Verify that insulation will span metal deck flutes.
 - 1. Install insulation in full thickness indicated in a minimum of two layers and to provide a level base for application of insulation cover board. Stagger end joints between rows of each layer. Stagger joints of second layer from joints of previous layer a minimum of 6 inches in each direction. Lay in 48 inches wide courses and in largest pieces possible in order to reduce the number of joints in the finished application.
 - 2. Cut and fit insulation for tight fit between members and penetrations without gaps or voids.
 - 3. Do not install more insulation than can be made water-tight with roofing the same day or start of inclement weather.
 - 4. Insulation shall not be installed so as to bridge across expansion joints or other similar devices.
 - 5. Roofing shall not be applied over wet insulation. Insulation which has become wet after installation shall be removed and replaced with dry material before applying built-up roofing.
 - 6. Secure insulation in place with mechanical fasteners in accordance with the concrete roof tile manufacturer requirements, but not less than minimum fastening to comply with specified Performance Requirements.
- B. Cover Board: Install cover boards over insulation with long joints in continuous straight lines and end joints staggered between rows.
 - 1. Stagger cover board joints from joints of insulation below a minimum of 6 inches in each direction.
 - 2. Loosely butt cover board edges together and fasten to roof deck with pre-applied primer side facing up.

3. Secure cover boards in place with mechanical fasteners or adhesive in accordance with the concrete roof tile manufacturer requirements, but not less than minimum fastening to comply with specified Performance Requirements.
 - a. Install fasteners with plates through the roof board, flush with surface.
 - b. Install roof board parallel to or perpendicular to deck ribs.
 - c. Provide fasteners in quantity and spacing as required for specified wind uplift indicated on General Structural Notes on Structural Drawings.
 - d. Increase fastener density by 50 percent at roof corners and roof perimeter.

3.04 INSTALLATION - UNDERLAYMENT

- A. Underlayment: Install two (2) layers in shingle fashion placed at right angles to roof pitch according to 2012 IBC requirements for roof pitch and TRI Guide MC 01A, MC 01B and manufacturer's instructions. Offset joints of second layer a minimum of 6 inches.

3.05 INSTALLATION

- A. Installation – General: Install according to TRI Installation Manual, and manufacturer's written application instructions.
- B. Battens: Install plastic battens in strict accordance with Manufacturer's Instructions with recommended fasteners placed at recommended spacing and located on nail markings.
- C. Roof Layout: Layout according to the TRI Installation Manual, and as indicated on Drawings.
 1. Install field tile in courses beginning at eave working up incline of roof deck.
 2. Install tiles in vertical rows at spacing and exposure in accordance with referenced standards and manufacturer's instructions.
 3. All tiles in contact with cement mortar shall be immersed in water for two minutes before installation.
- D. Vent Pipes: Install according to the TRI Installation Manual, Appendix A for vent pipe flashing.
- E. Eave/Gable: Install according to the TRI Installation Manual, Appendix A for eave/gable flashing installation.
 1. Underlayment Wrapped Gable:
 - a. Extend underlayment beyond rake/gable end. Fold down onto fascia or barge board, minimum of 1 inch. Secure with nails and tin tags, round cap nails or other fasteners 6 inches on center.
 - b. Trim underlayment at fascia or barge board. Install a peel and stick underlayment extending underlayment beyond rake/gable end. Fold down and seal onto fascia or barge board.
- F. Bird stops and starters:
 1. Install birdstops along entire length of all eaves.
 2. Install first course of pan tile leaving a 2 to 3 inch overhang at eave.
- G. Hip and Ridge: Install according to the TRI Installation Manual, Appendix A for hips and ridges, unless otherwise indicated on Drawings.
 1. Provide cement mortar or other approved materials at all hips and ridges to completely fill voids and to weatherproof the roof.
 2. All hip, ridge and first row of cover tiles after gable roll shall be set in cement mortar and fastened by non-corrosive nails.

- H. Rake: Install according to the TRI Installation Manual, Appendix A for rake installation.
 - 1. Rake Gable Tile:
 - a. Install first rake tile the exposed length of first course of field tile with factory finish of rake tile towards the eave.
 - b. Fasten rake tile with a minimum two 10D nails and /or of sufficient length to penetrate the framing a minimum of 3/4 inch.
 - c. About each succeeding rake tile to the nose of the field tile above and maintain a constant head lap.
- I. Valleys: Install according to the TRI Installation Manual, Appendix A for valley installation.
- J. Side Wall Flashing: Install according to the TRI Installation Manual, Appendix A for side wall flashings.
- K. Strip in metal flashings with self-Adhering, high-temperature, butyl-based flashing membrane.
- L. Head and Apron Flashing: Install according to the TRI Installation Manual, Appendix A for head and apron flashing.
- M. Adhesive Fastening: Refer to the TRI Installation Manual, Appendix B for adhesive fastening.
- M. Visually inspect application from ground level after installing 100 tiles to verify roof tile color is uniform and even, and verify that tile courses are straight and true.
 - 1. Correct and color or installation problems before proceeding with installation.
 - 2. Complete installation to provide weather tight service.

3.06 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

3.07 PROTECTION

- A. Construction Traffic: Protect materials and take precautions to prevent other trades from damaging roof during and after construction. Repair torn or punctured materials before roofing over. Use runways over materials in place.
- B. Waterstopping: At the end of each day's work, the work performed during that day shall be sealed at the edges and well covered to prevent moisture from entering under the material. Contractor shall take necessary precautions during installation to insure that moisture from inclement weather shall be prevented from entering the building where interior finishes are in place and/or building is occupied.

END OF SECTION

SECTION 07 53 16

SINGLE-PLY TPO MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes fully adhered single ply thermoplastic polyolefin (TPO) membrane roofing system composed of thermoplastic polyolefin laminated to non-woven polyester fleece backing.

1.02 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 "Terminology Relating to Roofing and Waterproofing"; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute "Glossary of Roofing Terms" for definition of terms related to roofing work in this Section.
- B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and Flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Roofing System Design: Design membrane roofing system that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressures calculated in accordance with ASCE 7 for roof field, corner and perimeter, but not less than Design Wind Pressures indicated on General Structural Notes on Drawings, whichever is more stringent.

1.04 SUBMITTALS

- A. Product Data: Submit the following:
 - 1. Manufacturer's Specifications, product test reports, installation instructions and evidence of UL and FM ratings for system.
 - 2. Research/Evaluation reports for components of membrane roofing system.
- B. Wind Design Review: Submit information required for wind design review on Manufacturer's standard form prior to installation of the roofing system.
- C. Shop Drawing: Submit Shop Drawings, including 1/8 inch minimum scale plans, roofing assembly sections and 3/4 inch minimum scale details of installation for all anticipated roofing conditions. Include the following:
 - 1. Layout of roof walkways.
 - 2. Details of application, including details of base flashings, membrane terminations.
 - 3. Locations and type of penetrations including perimeter and penetration details.

4. Insulation thickness and details of installation, including tapered insulation layouts and slope patterns with slopes indicated.
 5. Calculations for attachment of wood nailers.
- D. Installer Certificates: Provide installer certificates for roofing membrane installers, signed by roofing system Manufacturer certifying installers are approved, authorized and licensed by the Manufacturer to install their product and the following additional information:
1. Copies of the Manufacturer's general installation guidelines.
 2. Samples of each material to be used in the roof system, including each component Manufacturer's literature.
 3. Written approval by the material Manufacturer for use and performance of the insulation in the proposed system.
 4. Specimen copy of the roofing system Manufacturer's warranty.
- E. Certification from both Manufacturer and installer that the substrate and the details are proper and adequate for materials being furnished.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- H. Research/Evaluation Reports: For components of membrane roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Copy of Manufacturer's Inspection Report of completed roof installation.
- K. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing products specified, with minimum 5 years documented experience, including UL listing for membrane roofing system as specified.
 2. Installer: A qualified firm that is approved, authorized, or licensed by the roofing system Manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty, and has successfully installed a minimum of five fully adhered single ply membrane assemblies equivalent to that of this Project in the last three years.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E548.
- C. Test Reports:
1. Roof drain and leader test or submit plumbers verification.
 2. Core cut (if requested).
- D. Source Limitations: Obtain all components from single source roofing manufacturer.

- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A per ASTM E108, for application and roof slopes indicated.

- F. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Meetings." Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

- G Membrane Manufacturer's Representative shall inspect the installation of the roofing system.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to job site in original, unopened containers labeled with the Manufacturer's name, brand name and installation instructions.

- B. Job site storage temperatures in excess of 90 degrees Fahrenheit may affect shelf life of curable materials (i.e. uncured flashing, adhesives, sealants, primers, tape, pourable sealer and pressure-sensitive flashings).

- C. When liquid adhesives and sealants are exposed to lower temperatures, restore to a minimum of 60 degrees Fahrenheit before use. Do not store adhesive containers with opened lids due to loss of solvent, which will occur from flash off.

- D. Insulation must be stored so it is kept dry and is protected from the elements. Store insulation on a skid and completely cover with a breathable material such as tarp or canvas. If the insulation is lightweight, it should be weighted to prevent wind damage.

- E. Inspect all materials for conformance to Specification. Materials found that are not approved or do not meet required standards will be marked as "rejected" and permanently removed from the job site.

- F. Verify that all materials are protected before, during and after arrival at the job site. Verify that all materials have been adequately protected from moisture damage while in transit.

1.07 PROJECT CONDITIONS

- A. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry the surface prior to application.
- B. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.
- C. Arrange work sequence to avoid use of newly-constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over polyester felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.
- D. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.
- E. The Contractor shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.
- F. Flammable adhesives shall not be stored or used in the vicinity of open flames, sparks, and excessive heat.
- G. The single-ply TPO adhered membrane shall not be installed under the following conditions without consulting the roofing system Manufacturer for precautionary steps:
 - 1. The roof assembly permits interior air to pressurize the membrane underside at a rate of 2.61 pounds per foot 2 or greater (equivalent to 1/2 inch water rise).
 - 2. Any exterior wall has ten percent (10 percent) or more of the surface area comprised of opening doors and/or windows.
 - 3. The wall/deck intersection permits air entry into the wall flashing area.

1.08 WARRANTY

- A. Manufacturer's Warranty: Furnish written "No Dollar Limit" (NDL) warranty covering materials and labor required to maintain roofing in a watertight condition from date of Substantial Completion of the Work for the following length of time:
 - 1. 20 Years.
 - 2. Warranty shall cover repair or replacement of roofing system components that fail in materials or workmanship, at no cost to Owner.
 - 3. Warranty shall cover all materials and installation from the structural deck up including, but not limited to, insulation, membrane, flashings, fasteners, sealants, accessories, and walkway pads.
 - 4. Warranty shall be written on Manufacturer's standard form.

- B. Installer's Warranty: Furnish roofing installer's standard 2 year warranty covering materials and labor required to maintain roofing in a watertight condition from date of Substantial Completion of the Work.
 - 1. Warranty shall cover repair or replacement of roofing system components that fail in materials or workmanship.
 - 2. Warranty shall cover all materials and installation from the structural deck up including, but not limited to, insulation, membrane, flashings, fasteners, sealants, accessories, and walkway pads.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the specified manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 - 1. Carlisle Syn Tec www.carlisle-syntec.com
 - 2. Dow Roofing Systems www.dowroofingsystems.com
 - 3. Firestone Building Products www.firestonebpco.com
 - 4. Johns Manville Roofing Systems www.jm.com
 - 4. Mule-Hide Products Co., Inc. www.mulehide.com
 - 5. Seaman Corporation, Fibertite www.fibertite.com

2.02 MATERIALS

- A. Fabric Reinforced Thermoplastic Polyolefin Sheet: Uniform flexible sheet formed from a thermoplastic polyolefin, internal fabric or scrim reinforced and as follows:
 - 1. Thickness: Minimum, 80 mils, nominal.
 - 2. Exposed Face Color: White (unless noted otherwise).
 - 3. Physical Properties:
 - a. Breaking Strength: 225 lbf; ASTM D751, grab method.
 - b. Elongation at Break: 15 percent; ASTM D751.
 - c. Tearing Strength: 55 lbf minimum; ASTM D751, Procedure B.
 - d. Brittleness Point: Minus 22 deg F.
 - e. Ozone Resistance: No cracks after sample, wrapped around a 3 inch diameter mandrel, exposed for 166 hours to a temperature of 104 deg F and an ozone level of 100 pphm; ASTM D1149.
 - f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break and tearing strength after 166 hours at 240 deg F; ASTM D573.
 - g. Water Absorption: Less than 4 percent mass change after 166 hours immersion at 158 deg F; ASTM D 471. Linear Dimension Change: Plus or minus 2 percent; ASTM D1204.
 - h. CRCC initial solar reflectance of .79 per ASTM C1549.
 - i. CRCC initial thermal emittance of .90 per ASTM C 1371.

2.03 ACCESSORIES

- A. Membrane Flashing: 80 mil, non-woven, polyester-reinforced membrane matching roofing membrane material. Provide for field fabricated vent stack, pipes and corners.
- B. Adhesives and Cleaners: Provide Manufacturer's standard water based bonding adhesive, edge sealant, sealer, cleaner, and splicing cement as required.
- C. Membrane Clad Metal Edge: 24 gauge galvanized sheet metal with 20 mil membrane laminate.

- D. Termination Bar: 14 gauge steel termination bar with pre-punched holes at 1 inch center to center spacing, complying with FM 4470, corrosion resistance requirements.
- E. Reglet: Extruded aluminum counterflashing with pre-punched holes at 8 inches center to center spacing, prefabricated splice plates and inside/outside corners.
- F. Membrane Fasteners and Plates: Manufacturer approved screws and plates.
- G. Flexible thermoplastic cord to be hot air welded at termination bar.
- H. Peel Stop Bar: As manufactured by the membrane material Manufacturer.
- I. Corner Reinforcements and Penetration Flashings: Prefabricated 60 mil thick corner reinforcements and cone shape boot flashing with stainless steel clamping ring, manufactured by the membrane material Manufacturer.
- J. Roof Insulation:
 - 1. Insulation: ASTM C1013 or 1289, Type II polyisocyanurate insulation complying with the following:
 - a. Foam plastic insulation shall be FM approved.
 - b. Thickness: Provide minimum thickness as indicated on Drawings, but not less than thickness required to provide the R-values indicated on Drawings, applied in a minimum of two staggered layers.
 - 2. Provide preformed crickets and tapered edge strips fabricated from tapered roof insulation.
 - 3. Tapered Roof Insulation: Roofing System Manufacturer's standard FM approved closed-cell lightweight expanded polystyrene (EPS) conforming to ASTM C578, Type I, II or VIII, fabricated to slopes indicated, 1/4 inch per ft. minimum, or as required to obtain positive drainage and slope to drains.
 - 4. Positive drainage shall be provided for at all roof areas even if tapered insulation or crickets are not indicated on drawings.
 - 5. The Contractor shall be responsible for verifying the compatibility of the insulation with the proposed roofing materials and Manufacturer. Compatibility shall include, but not be limited to, warranty, fire rating, fastening and detailing.
 - 6. Adhesive: Dow Insta-Stic, single component, moisture cured, polyurethane insulation adhesive as manufactured by Dow Chemical Company, or as otherwise approved by the roof membrane manufacturer and complying with performance requirements for wind up-lift.
- K. Cover Board: Dens-Deck, thickness as required by roofing manufacturer, glass-mat faced, water-resistant gypsum substrate board complying with ASTM C1177 as manufactured by Georgia Pacific Corporation, or other membrane underlayment board approved by roofing system manufacturer and required by specified warranty.
- L. Fasteners and Anchors: Fasteners for termination bars, reglets, membrane clad edge, and similar items:
 - 1. All fasteners, anchors, nails straps, bars, etc. shall be of post-galvanized zinc or cadmium-plated steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1.25 inches and shall be approved for such use by the fastener Manufacturer. All wood fasteners and anchors shall have a minimum embedment of one 1 inch and shall be approved by the fastener Manufacturer.
 - 2. All exposed fasteners shall have 5/8 inch steel/neoprene washers under head.

- M. Sealants and Pitch Pocket Fillers:
 - 1. Sealants: Provided by or as approved by the membrane material Manufacturer. Sealants provided by other than membrane Manufacturer shall be compatible with membrane and flashing materials and applied according to Manufacturer's instructions. Sealants must not be pitch extended, must be exterior grade and suitable for horizontal or vertical applications according to their usage as recommended by Manufacturer.
 - 2. Temporary overnight tie-ins. The following sealants are accepted for temporary overnight tie-ins:
 - a. Type III steep asphalt conforming to ASTM D312 (latest revision).
 - b. One-part urethane.
 - c. Multiple layers of roofing cement and felt.
 - 3. Mechanical attachment of rigid bars may be necessary to secure the edge of the membrane into and under the sealant.
- N. Wood Blocking: In accordance with Section 06 10 00.
- O. Sheet Metal Flashing and Counterflashing: In accordance with Section 07 60 00.
- P. Walkway: TPO walkway rolls, or factory-formed, non-porous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from the membrane roofing system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Installer of roofing system shall examine substrate and conditions under which Roofing Work is to be performed and must notify Contractor immediately of unsatisfactory conditions. Do not proceed with Roofing Work until unsatisfactory conditions have been corrected in manner acceptable to installer.
- B. The roof deck and existing roof construction must be structurally sound to provide support for the new roof system.
- C. A dry, clean and smooth substrate shall be provided to receive the adhered single-ply roof system.
- D. The Contractor shall inspect the roofing surface for defects such as excessive surface roughness, contamination, structural inadequacy or any other condition that will adversely affect the quality of work.

3.02 PREPARATION

- A. Comply with Manufacturer's instructions for preparation of substrate to receive roofing system.
- B. Install metal flashings and similar accessory items as recommended by Manufacturer.
- C. Install wood nailers as recommended by Membrane Manufacturer.
- C. Prevent compounds from entering and clogging drains, conductors and gutters, and from spilling or migrating onto surfaces of other Work.

3.03 INSTALLATION

- A. Insulation Installation:
1. Comply with roofing system manufacturer's written instructions for installing roof insulation.
 2. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer's instruction.
 3. Install tapered insulation under area of roofing to conform to slopes indicated and as required to slope to drains.
 4. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 5. Extend insulation full thickness in a minimum of two layers to achieve required thickness, with joints staggered between layers, over entire surface to be insulated, cutting and fitting within 1/4 inch of nailers, projections, and penetrations.
 6. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 7. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
 8. Adhered Insulation: Install insulation to the deck with adhesive in accordance with manufacturer's recommendations and per FMG's "Approval Guide" for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-57. Install subsequent layers of insulation to achieve required taper thickness, as required per FM assembly testing, in cold adhesive and to achieve Factory Mutual Windstorm Resistance Classification.
 9. Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.
- B. Cover Board: Where cover board is indicated at copped roof areas, install cover board over insulation in accordance with Manufacturer's instructions and roofing Manufacturer's recommendations.
- C. Adhered Membrane Installation: Comply with Manufacturer's written instructions for installation of the membrane and as follows:
1. Begin installation only in presence of Manufacturer's Technical Representative.
 2. Unroll sheet and allow to relax for a minimum of 30 minutes.
 3. Position membrane over the acceptable substrate. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.
 4. Apply bonding adhesive in accordance with the Manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply bonding adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
 - a. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
 - b. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.
 5. Position adjoining sheets to allow a minimum overlap of 2 inches.
 6. Hot air weld the membrane sheets using automatic hot air welding machine or hot air hand welder in accordance with the Manufacturer's hot air welding procedures.
 7. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the hot air weld has been completed.

8. Apply bonding adhesive to the exposed underside of the membrane sheet and the substrate.
9. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
10. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.
 - a. Around all perimeters, at the base of walls, drains, curbs, vent pipes or any other roof penetrations, fasteners and discs shall be installed. Fasteners shall be installed per Manufacturer's instructions. Fasteners shall be installed using the fastener Manufacturer's recommended fastening tools with depth locators.
 - b. Membrane flashings shall extend three (3) inches past the discs and be hot-air welded to the deck sheet.
11. The Contractor shall inspect the roofing surface for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

3.04 HOT-AIR WELDING OF LAP AREAS

- A. General:
 1. All seams shall be hot air-welded. Seam overlaps shall be a minimum of 3 inches wide when automatic machine welding, and a minimum of 4 inches wide when hand welding.
 2. Welding equipment shall be provided by or approved by the roofing system Manufacturer. All mechanics intending to use the equipment shall have successfully completed a course of instruction provided by a roofing system Manufacturer representative prior to welding.
 3. All membrane to be welded shall be clean and dry. No adhesive shall be in the seam.
- B. Hand Welding: Hand welded seams shall be completed in three stages. Hot-air welding equipment shall be allowed to warm up for at least 1 minute prior to welding.
 1. The seam shall be tack welded every 3 feet to hold the membrane in place.
 2. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
 3. The nozzle shall be inserted into the seam at a 45 degree angle. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1-1/2 inch wide nozzle shall be used. For corners and compound connections, the 3/4 inch wide nozzle shall be used.
- C. Machine Welding:
 1. Machine welded seams are achieved by the use of automatic welding equipment supplied or accepted by the roofing system Manufacturer. When using this equipment, system Manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection shall be observed. The automatic welding machines require 218 to 230 volts at 30 amps. House power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.
 2. When welding membrane adhered with water-based adhesive, metal tracks must be used over the deck sheet and under the machine welder to prevent wrinkles.

- D. **Quality Control of Welded Seams:** The Contractor shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator. 1 inch wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Contractor at no extra charge.

3.05 MEMBRANE FLASHINGS

- A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashings shall be adhered to compatible, dry, smooth surfaces.
- B. **Water Based Adhesive for Flashings:**
1. Over the properly installed and prepared flashing substrate, water based adhesive shall be applied using 3/4 inch nap paint rollers. The adhesive shall be applied at a rate according to the roofing system Manufacturer's requirements. The adhesive shall be applied in smooth, even coatings with no holidays, globs or similar irregularities. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The surface with adhesive coating shall be allowed to dry completely prior to installing the membrane.
 2. Note: Drying time increases with cooler temperatures.
 3. When the surface is dry, the flashing membrane is cut to a workable length and the underside shall be evenly coated with water based adhesive at a rate according to the roofing system Manufacturer's requirements. When the adhesive has dried sufficiently to produce strings when touched with a dry finger, the coated membrane shall be rolled onto the previously coated substrate being careful to avoid wrinkles. The amount of membrane that can be coated with adhesive will be determined by ambient temperature, humidity, and the efficiency of the crew. Adjacent sheets shall be overlapped 3 inches. Membrane flashings shall extend 4 inches onto the roofing membrane. The bonded sheet shall be pressed firmly in place with a hand roller.
 4. No adhesives shall be applied in the seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.
- C. Install "peel stop bar" fastened 12 inches on center with acceptable fasteners into the structural deck at the base of parapets, walls, and curbs. Peel stop bar shall also be installed at the base of all tapered edge strips and at transitions, peaks, and valleys according to the roofing system Manufacturer's details.
- D. The roofing system Manufacturer's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by the roofing system Manufacturer prior to installation. If conflicts between the Manufacturer and the Specification arise, the more stringent will supercede.
- E. All flashings shall extend a minimum of 8 inches above roofing level. Where indicated, extend flashing membrane up back of parapets and over blocking under wall coping (cap flashing) as indicated on Drawings.
- F. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the PVC membrane.

- G. All flashings shall be hot-air welded at their joints and at their connections with the roof membrane.
- H. All flashing membranes shall be mechanically fastened along the top edge through tin discs spaced at a maximum of 12 inches on center.
- I. The roofing system Manufacturer's flashings shall be terminated according to the system Manufacturer's recommended details.
- J. Fully adhere asphalt resistant flashing sheet atop the parapet and curb locations.

3.06 MEMBRANE CLAD METAL EDGE

- A. All flashings shall be installed concurrently with the roof membrane as the job progresses.
- B. PVC clad metal flashings shall be formed and installed per the detail drawings.
- C. All metal flashings shall be fastened into solid blocking with two (2) rows of post-galvanized screws, six inches on center. The joint shall be covered with 2 inch wide aluminum tape. A 4 inch wide strip of PVC flashing membrane shall be hot-air welded over the joint.
- D. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- E. Adjacent sheets of PVC clad metal shall be spaced 1/4 inch apart. The ends of clad metal shall be fastened 6 inches on center. The joint shall be covered with 2 inch wide aluminum tape. A four inch wide strip of PVC flashing membrane shall be hot-air welded over the joint.
- F. All exposed fasteners shall have 5/8 inch steel/neoprene washers under head.

3.07 TEMPORARY CUT-OFF

- A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100 percent watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing.

3.08 ROOF WALKWAY

- A. Install walkway products in locations indicated on Drawings around roof mounted equipment and to provide walkways to roof access points. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

- A. Manufacturer's Inspection: The completed installation shall be inspected by a representative of the Manufacturer in the presence of the Owner's Representative to verify that it complies with Manufacturer's published requirements.
- B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.10 CLEANING

- A. Perform daily clean-up to collect wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

3.11 PROTECTION

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Flashings, sheet metal work and related items including, but not limited to:
 - 1. Counterflashing at vertical surfaces.
 - 2. Flashing at roof penetrations.
 - 3. Edge flashing.
 - 4. Sheet metal gutters and downspouts.
 - 5. Metal copings and wall caps.
 - 6. Installation of self-adhering waterproofing underlayment under copings, wall caps and sills.
- B. Related Sections:
 - 1. Section 07 53 16 – Single-Ply TPO Membrane Roofing, for coated metal flashing and sheet flashing materials associated with single ply TPO roofing system.
 - 2. Section 10 73 23 – Car Shelters, for flashing and trim associated with steel framed car shelters.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings indicating type of material, gauge, dimensions, profiles, locations where used, fastening and anchoring methods, joints, and provisions of expansion and contraction.
- B. Samples: Submit samples of each type of prefinished metal in selected color.

1.03 QUALITY ASSURANCE

- A. Standards:
 - 1. Comply with design and installation methods of SMACNA Architectural Sheet Metal Manual.
 - 2. Comply with The NRCA Roofing and Waterproofing Manual installation details.
 - 3. Comply with ANSI/SPRI, ES I-98.
- B. Performance Requirements: Designed and installed to withstand wind pressures in compliance with ANSI/SPRI, ES I-98, or FMG Loss Prevention Data Sheet 1-49 for Class 1-90 wind rated design, or wind load design criteria indicated on General Structural notes on Drawings, whichever is greater.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site. Do not store materials on ground.
- C. Handling: Comply with Manufacturer's instructions. Handle with care so as not to buckle or warp metal, or damage solder joints.

1.05 WARRANTY

- A. Furnish 5 year warranty against flashing and sheet metal failure, in which contractor agrees to repair or replace flashing and sheet metal as necessary to maintain work in watertight condition during the warranty period. Warranty to cover workmanship, materials and repair or replacement of same, at no cost to Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Prefinished Metal:
 - 1. Hot-dipped galvanized, ASTM A653 Structural Quality, Grade 40, G90 coating 24 gauge core steel, or prefinished Galvalume - ASTM A792.
 - 2. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14.
 - 3. Finish: Full strength Kynar 500/Hylar 5000 Fluorocarbon coating, applied by the Manufacturer on a continuous coil coating line, with top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil.
 - a. Bottom side: Coated with primer with a dry film thickness of 0.25 mil.
 - b. Finish: Conform to all tests for adhesion flexibility, and longevity as specified by the Kynar 500 finish supplier.
 - c. Color: Custom color as selected by Architect.
 - 4. Strippable film: Liquid applied to top side of painted coil to protect finish during fabrication, shipping and field handling.
- B. Galvanized Steel: ASTM A653, 24 gauge minimum and as indicated, with G-60 coating. Used for sheet metal flashing and trim at concealed from view locations and concealed clips and reinforcements only.

2.02 ACCESSORIES

- A. Reglets and Counterflashings: Fry Reglet Corporation, Type SM at masonry and Concrete, or fabricated as indicated on Drawings. Provide prefabricated inside and outside reglet and counterflashing corners.
- B. Solder: ASTM B32, 50/50 type.
- C. Flux: FS O-F-506.
- D. Sealant: As specified in Section 07 92 00.
- E. Plastic Cement: ASTM D4586.
- F. Bituminous Coating: FS TT-C-494 or SSPC paint - 12, dry film 15 mils per coat.
- G. Sheet Metal Fasteners: Galvanized steel with soft neoprene washers at exposed fasteners.

- H. Self-Adhering Waterproofing Underlayment:
 - 1. High-temp resistant, flexible, self-adhering rubberized asphalt sheet membrane underlayment with polymer film and removable treated release film on adhesive side; TAMKO TW Underlayment www.tamko.com
 - 2. High-temperature resistant, flexible, self-adhering butyl-based sheet membrane underlayment with high density cross laminated polyethylene backed and removable plastic release film on adhesive side, self-adhering flashing membrane, Grace Ultra or equivalent www.grace.com/construction/en-us.
- I. Prefinished Metal Seam Sealers and Adhesives: As recommended by prefinished metal manufacturer for waterproof and weather-resistant seaming and adhesive applications of flashing and sheet metal work.
 - 1. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape.
 - 2. Butyl Sealant: ASTM C1311, single-compound, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

2.03 FABRICATION

- A. Fabricate Flashing and sheet metal from the following:
 - 1. Fabricate flashing and sheet metal exposed to view in the finished work, including wall caps/coping), fascia, drip edges, etc., from prefinished metal sheet.
 - 2. Fabricate flashing and sheet metal concealed from view in the finished work from galvanized steel.
- B. Fabricate gutters and downspouts in accordance with the following Figure(s) and Table(s) from the SMACNA Architectural Sheet Metal Manual and as indicated on drawings. Fabricate gutters by extrusion roll-forming from prefinished metal sheet to profile indicated on Drawings or as otherwise approved by Architect.
 - 1. Gutters: Figures 1-1 through 1-24D and Tables 1-5, 1-7 and 1-8, as applicable to design indicated.
 - 2. Downspouts: Figures 1-31 through 1-36 and Table 1-9, as applicable to design indicated.
- C. Fabricate sheet metal flashing and trim with lines, arris, and angles sharp and true, and plane surfaces free from objectionable wave, warp or buckle. Form accurate to details.
 - 1. Fabricate flashings as indicated on Drawings. Return and brake edges.
 - 2. Hem exposed edges to form a 1/2 inch wide hem on the side concealed from view.
 - 3. Provide concealed stiffeners and reinforcements as necessary to provide surfaces free of objectionable wave, warp or buckle.
 - 4. Profiles, bends, and intersections shall be even and true to line.
 - 5. Provide hold-down clips for large cap flashings as necessary to comply with performance requirements.
- D. Forming, anchoring, expansion and contraction details shall conform to referenced quality standards.
- E. Provide for thermal expansion of running trim, flashing, expansion joints, and other items exposed for more than 15 feet continuous length.
- F. Fabricate cleats and starter strips of same material as sheet.

- G. Form pieces in longest practical lengths, except form flashing and fascia in 8 to 10 foot units.
- H. Fabricate coping covers and wall caps with butt seam with backup plate, fastened one side seams (item 19, figure 3-3 per SMACNA Architectural Sheet Metal Manual). Miter all parapet coping corners.
- I. Solder and seal metal joints or use seam sealer/adhesive as recommended by prefinished metal manufacturer. After soldering, remove flux. Wipe and wash solder joints clean.
- J. Fabricate corners from one piece with minimum 18 inch long legs, with mitered corners; solder for rigidity, seal with sealant.
- K. Where prefabricated counterflashing and reglet system is used, form upper edge of counterflashing with an approved snap lock flange to engage reglet receiver and to provide a spring action at bottom edge against built-up flashing.

2.04 FINISH

- A. Shop prepare and prime exposed ferrous metal surfaces of unfinished galvanized steel sheet.
- B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 1.5 mil.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 1. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
 - 2. Verify membrane termination and base flashings are in place, sealed, and secure.
 - 3. Verify substrate is dry, clean and free of foreign matter.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.
- C. Correct defects prior to installation.

3.02 INSTALLATION

- A. Installation shall conform to NRCA and SMACNA manuals.
 - 1. Slope to provide positive drainage.
 - 2. Provide sufficient hold-down clips to insure true alignment and security against wind.
 - 3. Install with 4 inch minimum overlap.
 - 4. Bed overlap joints in appropriate sealant as specified in Section 07 92 00.
 - 5. Form and lap step flashings.
 - 6. Allow sufficient tolerances for expansion and contraction.
 - 7. Insulate work to prevent electrolytic action.

- B. Self-Adhering Waterproofing Underlayment: Install self-adhering waterproofing underlayment under copings, wall caps, and similar horizontal locations.
1. Install waterproofing underlayment in widths to cover top of wall or horizontal surface being installed. Extend underlayment down each side of wall as detailed on Drawings.
 2. Waterproofing membrane shall be completely concealed by metal coping.
 3. Make end laps 4 inches minimum. Where width of wall requires multiples widths of waterproofing underlayment, make side laps 4 inches minimum.
 4. Install coping and wall caps over installed waterproofing underlayment.
- C. Expansion Seams: Maintain a watertight installation at expansion seams. Locate expansion seams as shown or if not shown, at the following maximum spacing for each general flashing use:
1. Flashing, expansion joints, gravel stops, and trim: At 10 foot intervals, 24 inches on each side of corners and intersections.
 2. Sealant-type expansion joints: Where sealant-filled expansion joints are used, embed the hooked flanges of the joint members not less than 1 inch into the sealant. Form joints to completely conceal the sealant. When ambient temperature is moderate at the time of installation (40 to 70 degrees F.), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40 degrees F. Installation of sealant is specified in Section 07 92 00.
- D. Where dissimilar materials abut, provide proper separation or protection to minimize the possibility of galvanic action.
- E. Soldering:
1. Solder joints at corner fabrications.
 2. Except where other methods of joining are indicated or specified, solder joints and connections of Sheet Metal Work.
 3. Remove grease and dirt from metal surfaces to be joined.
 4. Remove flux residue by scrubbing, neutralizing with ammonia or a 5 to 10 percent solution of washing soda, followed by a clear water rinse.
 5. Assemble parts and solder using regular non-corrosive resin flux. Heat metal thoroughly to completely sweat solder through full contact area.
- F. Sealed Joints: Form nonexpansion, but movable joints in metal with flat lapped seams to accommodate elastomeric sealant to comply with SMACNA Standards. Fill joint with sealant and form metal to completely conceal sealant.
1. Seal joints at copings and at other movable, non-expansion type joints.
- G. Reglets: Install reglets in masonry, concrete or stucco to receive flashings.
- H. Counterflashing:
1. Provide metal counterflashing at top edges of built-up base flashings and at other locations indicated.
 2. Lap end joints a minimum of 3 inches. Do not solder or weld joints. Make flashing continuous at angles. Counterflashing shall overlap base flashing a minimum of 4 inches, unless otherwise indicated.
 3. Where counterflashing terminates in reglets, fasten flashing with lead wedges every 12 inches. Fill reglets continuously with synthetic rubber type sealant.

- I. Copings and Wall Caps:
 1. Cover top of parapet walls with 20 gauge minimum prefinished metal coping formed to design shown.
 2. Coordinate installation of sheet metal coping with installation of self-adhering waterproofing underlayment placed over wall caps and copings. Waterproofing membrane shall be completely concealed by metal coping.
 3. Extend front edge of coping covering down over the lock into a previously placed continuous cleat. Secure edge strips with nails spaced 6 inches apart.
 4. Where flashing is indicated at back of wall or parapet where coping/wall cap is installed, join rear edge of coping covering to adjacent flashings as indicated.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Roof hatches.
 - 2. Pop-up safety posts for roof hatches.
 - 3. Roof curbs and equipment supports.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's Specifications, design data and installation instructions.
- B. Shop Drawings: Submit Drawings showing layout, dimensions and construction details.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements; proper fit and attachment of parts is required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as otherwise approved by the Architect, subject to compliance with Specifications requirements:
 - 1. Roof Hatches and Ladder Safety Posts:
 - a. Bilco Co. www.bilco.com
 - b. Bristolite www.bristolite.com
 - c. Babcock-Davis www.babcockdavis.com
 - d. Activar Inc. Construction Products Group, J.L. Industries Products www.activarcpg.com
 - e. Nystrom Building Products www.nystrom.com
 - 2. Roof Curbs and Equipment Supports:
 - a. AES Inc., Yerington, NV www.aescurb.com
 - b. Pate Co., Lombard, IL www.patecurbs.com
 - c. Roof Products, Inc., Phoenix, AZ www.rpicurbs.com
 - d. Roof Products & Systems, Bensenville, IL www.rpscurebs.com

2.02 MANUFACTURED UNITS

- A. Roof Hatch: Galvanized steel, 14 gauge cover and curb, 22 gauge cover liner. 1 inch thick rigid insulation in curb and cover, 12 inch high curb.
 - 1. Size(s): Provide roof access hatch of size indicated on Drawings, based on the following products as manufactured by Bilco www.bilco.com:
 - a. 36 x 30 inches for ladder access: Bilco Type S-20.
 - 2. Provide heavy-duty slam-type latching mechanism with heavy-duty padlock hasp.
 - 3. Provide vandal resistant features as available.
 - 4. Finish: Powder coat; standard color as selected.
- B. Curbs: Pate Style pc-1b, or equivalent from one of the specified manufacturers, box section design, heavy gauge galvanized steel construction, continuous mitered and welded corner seams, integral base plate, factory installed wood nailer, and insulated with 1-1/2 inch thick rigid fiberglass board insulation.
- C. Equipment Supports: Pate Style es-1, or equivalent from one of the specified manufacturers, monolithic construction, heavy gauge galvanized steel, continuous mitered and welded corner seams, integral base plate, factory installed 2 inch x 4 inch wood nailer, and heavy gauge galvanized steel counterflashing.
- D. Pipe Curb Assemblies: Pate Style pca-1, or equivalent from one of the specified manufacturers, with curb constructed of heavy gauge galvanized steel with continuous welded corner seams, factory installed wood nailer insulated with 1-1/2 inch thick rigid fiberglass board insulation, cover of acrylic clad ABS thermoplastic, including graduated step PVC, boots, adjustable stainless steel clamps and cap fastening screws. Each assembly shall include curb, cap, boots and clamps. See Drawings for size and quantity of pipe penetrations.
- E. Ladder extension (for roof hatches): Bilco Model 1 LadderUP safety post, or Bristolite Grab Bar.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install roof specialties at locations shown or required in accordance with Manufacturer's instructions and as detailed on Drawings.
- B. Install roof hatches, equipment supports and bases, curbs and curb assemblies, at locations indicated, fastening securely to deck through curb flange.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes firestopping as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Section 07 21 00 – Building Insulation, for fire safing insulation.

1.02 SYSTEM DESCRIPTION

- A. Provide UL Classified or Warnock Hersey Listed firestopping system to prevent the spread of fire, smoke and gasses through penetrations in fire resistive walls, including; but not limited to; the following areas:
 - 1. Unprotected openings and openings accommodating penetrating items such as cables, cable trays, pipes, ducts, boxes and conduits through fire rated walls.
 - 2. Head of wall openings between wall and connecting floor or roof deck assemblies.
 - a. Meet requirements for exposure to hose stream test.
 - b. Applicable for use with steel fluted deck floor assemblies.
 - b. Allow deflection of floor or roof above.
- B. Firestop systems shall not be intended to support live loads and traffic unless specifically approved by Testing Agency.
- C. Firestop systems shall be approved by Code Authority.
- D. Firestop products shall remain flexible where subject to movement without affecting the integrity of the product.

1.03 SUBMITTALS

- A. Product Data: Submit Manufacturer's Specifications, performance criteria, Drawings and instructions.
- B. Shop Drawings: Submit Manufacturer's complete Shop Drawings showing proposed material, reinforcement, anchorage, fastenings method of installation and UL or Warnock Hersey listing number.
- C. Test Reports: Submit UL or Warnock Hersey test report description for firestopping system.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of firestop systems.

1.04 QUALITY ASSURANCE

- A. Qualifications: Applicator with minimum of 5 years experience and approved by the materials manufacturer.

- B. Regulatory Requirements: Conform to applicable code for fire resistance ratings and surface burning characteristics:
 - 1. ASTM E 136, ASTM E 119 and ASTM E 814, as applicable.
 - 2. UL 1479 fire test to achieve required fire-rating as noted on Drawings.
 - 3. Listing:
 - a. UL Fire Resistance Directory (current edition).
 - b. WH International Listings
 - 4. UL 2079, "Test for Fire Resistance of Building Joint Systems."
- C. Pre-Installation Conference:
 - 1. Convene a pre-installation conference to review specifications and procedures with the Architect, Contractor, installer, manufacturer's representative, Owner and other trades relevant to the work, prior to ordering materials.
 - 2. Notify Architect at least 48 hours prior to starting Work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish firestop systems acceptable to governing Code Authority from one of the following Manufacturers, subject to compliance with Specification requirements:
 - 1. U.S. Gypsum Co. www.usg.com
 - 2. Johns-Manville www.jm.com or www.jmfirestopping.com
 - 3. Tremco, Inc. www.tremcosealants.com or www.tremcofirestop.com
 - 4. RectorSeal Corporation www.rectorseal.com
 - 5. 3M Fire Protection Products www.3m.com
 - 6. Specified Technologies, Inc. www.stifirestop.com
 - 7. HILTI Firestop Systems www.hilti.com
 - 8. Nelson Firestop Products www.nelsonfirestop.com
 - 9. Grace Construction Products – Flamesafe www.grace.com

2.02 MATERIALS

- A. Firestop System Materials - General:
 - 1. Appropriate for penetration.
 - 2. Include every component required for code approved installation, including; but not limited to:
 - a. Firestopping putties or compound.
 - b. Backing material.
 - c. Wrap strips.
 - d. Primers, clips and collars.
 - e. Forming and damming materials.
 - f. Cleaners.
 - g. Sealant and fireblock
 - h. Firestop devices.

- B. Properties:
 - 1. Free of asbestos, halogens and volatile components after curing and shall not slump or sag, (except for self-leveling products).
 - 2. Capable of maintaining an effective barrier against flames, heat and smoke in compliance with IBC requirements and the requirements of ASTM E814 and UL 1479 using the “F” or “T” rating to maintain the same rating and integrity as the fire barrier being sealed.
 - 3. Non-combustible per ASTM E 136.
 - 4. UV resistant where exposed to sunlight.
 - 5. Water resistant where exposed to moisture.
 - 6. Firestop system shall accommodate movement without adversely affecting fire rating of wall/floor assembly.
 - 7. Shrink resistant.
 - 8. Paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which affect bond.
- C. Install backing materials to arrest liquid material leakage, if required.

3.03 INSTALLATION

- A. Installation shall conform to requirements of qualified designs or manufacturer approved modifications as supported by engineering reports, and shall be approved and accepted by the authority having jurisdiction.
 - 1. Apply primer and firestop materials in accordance with Manufacturer's instructions and in accordance with the appropriate UL Fire Resistance Directory or with the appropriate Warnock Hersey International Listing.
 - 2. Apply firestopping material in sufficient thickness to achieve rating, to ensure against the passage of flames, smoke and toxic gases, and to a uniform density and texture.
 - 3. Protect materials from damage on surface subjected to traffic and install cover plates as required on firestop system that will or may be subject to traffic.
 - 4. Tool surfaces of firestop products to provide a smooth and clean appearance.
- B. Provide firestopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing or otherwise. Insulation types specified in other sections shall not be installed in lieu of firestopping materials.

- C. Interior Walls and Partitions:
 - 1. Construction joints between top of fire rated walls and underside of floors or roof above shall be firestopped.
 - 2. Firestop systems installed shall have been tested by either UL or Warnock Hersey, including exposure to hose stream test and including test for use with steel fluted deck floor assemblies.
 - 3. Firestop system used shall allow for deflection of floor or roof above.

- D. Penetrations:
 - 1. Penetrations include conduit, cable, wire, pipe, duct or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.
 - 2. Provide firestopping to fill spaces in accordance with ASTM E 814 (UL 1479) where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, except at floors on grade.
 - 3. Requirements for penetrations shall apply whether or not sleeves have been provided. Firestop the annular space between sleeve and surrounding surfaces.

3.04 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 07 92 00

JOINT SEALERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Joints sealants and installation accessories.
- B. Related Sections:
 - 1. Section 07 84 00 – Firestopping, for sealants at fire penetrations.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Submit Manufacturer's current specifications and recommended installation procedures.
 - 2. Submit sample warranty to be signed jointly by applicator and Manufacturer.
 - 3. Submit Manufacturer's standard color chart.
 - 4. Certification in the form of standard data sheet or letter that each type of compound and sealant to be furnished complies with these specifications.
 - 5. Statement that each product to be furnished is recommended for the application shown for this project.
 - 6. Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.
- B. Shop Drawings: Illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades.
- C. Field Adhesion Test and Stain Reports: Submit copies of logs and test reports showing results of field adhesion testing and stain testing.
- D. Submit three (3) samples of each specified product, 12-inch minimum lengths, and installed between representative samples of materials to be sealed for each product. Architect's acceptance will be for color only.
- E. Certifications: Submit certification signed jointly by Contractor and Sealant Manufacturer, certifying that products comply with specification requirements, are proper and adequate for the condition of installation and use, have been properly selected and designed for applications where they are to be installed, and that sealants and accessory materials have been installed in accordance with Manufacturer's printed instructions and recommendations of Manufacturer's field representative.
- F. Provide a procedure detailing the cleaning, priming, taping, tooling and other steps recommended to ensure satisfactory function and appearance.
- G. Contract Closeout: Submit Manufacturer's Warranty.

1.03 QUALITY ASSURANCE

- A. Qualifications: Installers shall be thoroughly trained and experienced in the necessary skills and shall be thoroughly familiar with the specified requirements.

- B. Field Adhesion Testing: Perform preconstruction adhesion testing for each type of sealant and substrate as follows:
1. Arrange for Manufacturer's field technical representative to be present during testing.
 2. Install sealant in test joints in minimum 60-inch lengths.
 3. Test joints by standard field adhesion hand pull test.
 4. For joints with dissimilar substrates, test adhesion to each substrate separately as recommended by sealant Manufacturer.
 5. Conduct number of field adhesion tests for each type of sealant and each type of substrate as follows:
 - a. Not less than 10 tests for the first 1,000 feet of installed sealant and 1 test for each additional 1,000 feet of sealant installed, or 1 test per floor per elevation.
 6. Document results of field adhesion tests and record results in field adhesion test log.
 7. Include in log data on pull distance used to test each joint sealant.
 8. Include data on joints where material connected with pull portion of sealant failed to adhere to joint substrate or tore cohesively.
 9. Inspect joints and record data for the following:
 - a. Complete fill.
 - b. No voids.
 - c. Joint dimensions matching those of Manufacturer's recommended details.
 10. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 11. Do not install joint sealants that fail to adhere to joint substrates during testing.
 12. Repair sealant test areas by removing damaged materials and applying sealant to test area using same procedure used to originally install the sealant.
- C. Stain Testing: Perform Stain testing of natural stone, masonry and other porous substrates proposed for use in the Work. Obtain actual samples of materials proposed for use and test to determine if permanent discoloration of porous surfaces will occur from direct contact with sealants. Perform stain testing in conformance with ASTM C1248 and as follows:
1. Arrange for Manufacturer's field technical representative to be present during examination of test results.
 2. Cut substrate to provide flat surface for application of sealant.
 3. Separate substrate materials by removable shims to create 1/2 x 1/2 x 3-inch joint.
 4. Fill joint with scheduled sealant, tool, and allow to cure for 21 days at room temperature.
 5. After 21-day curing, remove shims, compress joint to 50 percent of original joint width to 1/4 inch, and place in an oven at 158 degrees F. for 14 days.
 6. After 14 days in oven, remove and allow sample to cool to room temperature.
 7. Examine sample to determine presence of discoloration or change in appearance in any way to exposed surfaces.
 8. After visual inspection, cut sample in half to determine presence of discoloration or change in appearance in any way into the sample itself at the adhesive bond line and presence of bleeding into the area around the adhesive bond line.
 9. Document results of stain tests and record results in stain test log.
 10. Do not install sealants that show evidence of staining substrates.
- D. Field Color and Workmanship Samples: Seal a section of joint as directed, under job conditions, at least 7 days prior to start of work for review by Architect. When approved, sample shall be used as a standard of comparison for remainder of work.

- E. Manufacturer and sealants Subcontractor to submit log of testing, on company letterhead for each test performed indicating, but not limited to the following:
 - 1. Date
 - 2. Project identification
 - 3. Sealant identification including name, type and batch number
 - 4. Test performance, i.e., acceptable, marginal, not acceptable
 - 5. Storage conditions
 - 6. Signature of person conducting test
- F. Location where the test was conducted.
- G. If tests indicate sealant material is marginal or not acceptable, sealant is not to be used. Tester is to immediately notify Architect and Contractor of the deficient materials. The sealant Subcontractor is to immediately remove deficient materials from site.
- H. Inspections
 - 1. Coordinate sealant selection and application as necessary for the full and satisfactory compatibility and performance between all sealants used under this section with all other applicable and related sections using sealants that may be in direct contact with work of this section.
 - 2. Take all required steps and precautions to properly isolate and prevent any degree of incompatibility between sealants, all in strict accordance with Manufacturer's specifications, recommendations and instructions.
 - 3. Contractor is to periodically test sealants in place in addition to the Manufacturer's field testing, for adhesion, using methods recommended by sealant Manufacturer. Promptly replace all sealant that does not adhere or fails to cure.
 - 4. Contractor shall arrange to meet the sealant Manufacturer at the jobsite and witness initial installation of sealant on the project with the Contractor, Architect and other Consultants.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site. Maintain product in accordance with Manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- C. Handling: Comply with Manufacturer's instructions.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Observe Manufacturer's temperature service range. Do not apply sealant when weather conditions will inhibit bonding and curing.

1.07 WARRANTY

- A. Provide warranty, in writing and signed jointly by the installer and sealant Manufacturer, to replace sealants which fail at no additional cost to the Owner because of loss of cohesion or adhesion, or do not cure, and which fail to achieve air-tight and water-tight seal as follows:
 - 1. Sealant Types "A" and "B": 5 years.
 - 2. Sealant Types "C1" and "C2": 20 years.
 - 3. Sealant Types "D," "E" and "F": 2 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:
1. Pecora www.pecora.com
 2. Dow Corning Corp. www.dowcorning.com
 3. GE Construction Sealants, Division of Momentive Performance Materials Inc. www.siliconeforbuilding.com
 4. Sonneborn / Chemrex www.chemrex.com
- B. Single Source Responsibility for Joint Sealer Materials:
1. Obtain joint sealer materials from a single Manufacturer for each different product required.
 2. If sealants from separate Manufacturers must be used and could come in contact with each other, provide written certification from every Manufacturer involved that the sealants are compatible and will adhere to each other.

2.02 MATERIALS

- A. General: Sealants, primers, back-up materials, preformed joint fillers, bond breakers and related materials shall be compatible with adjoining materials.
- B. Sealant:
1. General: The selection of proper sealant for a particular joint shall be in accordance with current published recommendations of the Manufacturer.
 2. Types: See Schedule in Part 3 for the location where each type of sealant is to be provided.
 - a. Type "A": Ultra-low modulus, self-leveling, one-component, silicone sealant conforming to ASTM C920, Type S, Grade SL, Class 100/25, Use T, A, M, and O; Dow Corning SL Parking Structure Sealant (Self Leveling), Pecora 300/310 SL, or Tremco Spectrem 900 SL; OR Low-modulus, non-sag, one-component silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 100/25, Use T, A, M, and O. Dow Corning NS Parking Structure Sealant (Non-Sag), Pecora 301/311 NS, or Tremco Spectrem 800; OR Ultra-low modulus, fast-cure, two-component, neutral-cure silicone sealant conforming to ASTM C920, Type S, Grade FC, Class 100/25, Use T, A, M, and O; Dow Corning FC Parking Structure Sealant (Fast Cure). Pavement joint sealants shall comply with Section 729 of MAG
 - b. Type "B": Silicone sealant conforming to ASTM C920, Type M, Grade NS, Class 25, Use NT, M, A, O, and capable of withstanding movement of 50% in extension and compression, and sustained temperatures of 250 degrees F in service. Dow Corning 790, 795, CCS and CWS.
 - c. Type "C-1": One-part low modulus moisture cure silicone rubber sealant conforming to FS TT-S-001543A, Class A, FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O, and capable of withstanding movement of 100% in extension and 50% in compression in service. Dow Corning 790 Silicone Glazing Sealant or Pecora 890.

- d. Type "C-2": One-part medium modulus neutral cure silicone rubber sealant conforming to FS TT-S-001543A, Class A, FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O, and capable of withstanding movement of 50% in extension and 50% in compression in service. Pecora 895, Dow Corning 795 or Dow Corning 791 or 756 SMS (non-staining). Provide Dow Corning 756 SMS where sealant with reduced soiling is indicated.
 - e. Type "D": Medium-modulus, single-component, pre-pigmented, neutral-cure silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M, A, O. Dow Corning 756 SMS Building Sealant.
 - f. Type "E": Silicone rubber sealant with mold inhibitor. General Electric Sanitary 1700, Tremco Tremsil 200, Dow Corning 786, Pecora 898, Sonneborn Omni-Plus.
 - g. Type "F": Tremco Acoustical Sealant and Pecora BA-98.
- 3. Sealants at fire penetrations: As specified in Section 07 84 00
 - 4. Sealants at Mechanical Ductwork: As specified in Division 23.
 - 5. Color: Provide standard or custom colors as selected by Architect. In general, colors shall be matching the adjacent materials unless specifically noted otherwise on Drawings.
- D. Primer: Non-staining type, recommended by sealant Manufacturer to suit application.
 - E. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant Manufacturer; compatible with joint forming materials.
 - F. Joint Filler (Backer):
 - 1. Buildings: ASTM C1330, Type B; round bi-cellular or closed cell polyethylene, urethane or neoprene foam rod; oversized 30 to 50 percent; "SofRod" as manufactured by Nomaco.
 - 2. Pavement: ASTM D5249, Type 3, round bi-cellular or closed cell polyethylene, urethane or neoprene foam rod; oversized 30 to 50 percent; "SofRod" as manufactured by Nomaco.
 - G. Bond Breaker: Pressure sensitive tape recommended by sealant Manufacturer to suit application.
 - H. Gloss Reducer: Silica sand No. 20, color to match adjacent surface. Gloss reducer shall be provided at traffic sealant applications.
 - I. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the sealant Manufacturer as compatible, subject to the review by the Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces. Verify, before proceeding with this Work that required inspections of existing conditions have been completed.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Clean, prepare, and prime joints in accordance with Manufacturer's instructions. Remove loose materials, dust, oil, grease, water, surface dirt, frost, old caulking material and other foreign matter which may impair adhesion of sealant.
 - 1. Clean porous materials where necessary by grinding, sand or water-blast cleaning, mechanical abrading, acid washing or combination of these methods as required to provide a clean, sound base surface for sealant adhesion. Clean nonporous surfaces, either mechanically or chemically.
 - 2. Remove laitance by acid washing, grinding or mechanical abrading. Remove form oils by sand or water-blast cleaning. Remove all loose particles present or resulting from grinding, abrading or blast cleaning by blowing out joints with oil free compressed air or by vacuuming joint prior to application of primer or sealant.
 - 3. Remove protective coatings from metallic surfaces by two rag solvent wipe method. Use clean white cloths or lint free paper towels for cleaning with solvent and drying. Clean joint areas protected with masking tape or strippable film with solvent after removal of tape or film. Do not allow solvent to air dry without wiping.
- B. Verify that joint shaping materials and release tapes are compatible with sealant.
- C. Examine joint dimensions and size materials to achieve required width/depth ratios.
 - 1. Joint widths, depths, and conditions detailed on shop drawings by related work contractors shall be considered as minimum allowable requirements except where they may conflict with sealant Manufacturer's recommendations. In all cases, joints must be uniform in width. Do not seal joints until they are in compliance with drawings, or meet the accepted control section standard. Notify general Contractor and Architect of Conditions not compliant with Drawings or acceptable standards.
 - 2. Clean out and rake to full width and depth, joints to receive sealant, back-up material or preformed joint filler. Make joints of sufficient width and depth to accommodate specified back-up material or preformed joint filler and sealant.
- D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- E. Use bond breaker where required.
- F. Protect adjacent surfaces from damage by masking when necessary.

3.03 INSTALLATION

- A. General:
 - 1. Install sealant in accordance with Manufacturer's instructions.
 - 2. In general, seal openings and other locations which normally require sealant to seal against infiltration from air, water and most insects, including; but not limited to:
 - a. Construction and expansion joints.
 - b. Joints between dissimilar materials.
 - c. Joints around windows, door frames, louvers and other penetrations and openings in the exterior wall.
 - d. Interior wall openings.
 - e. Other locations indicated on drawings.

3. Follow sealant Manufacturer's instruction regarding surface preparation, priming, application life, and application procedure. Consult sealant Manufacturer for recommendation for application procedure. Apply sealant within recommended temperature ranges. Consult Manufacturer when sealant cannot be applied within recommended temperature ranges. Consult sealant Manufacturer for recommendation for application of silicone sealant when air temperature is below 40 degrees F., or surface temperatures of sealant contact surfaces are above 115 degrees F.
 4. Apply masking tape, where required, in continuous strips in alignment with joint edge. Remove tape immediately after joints have been sealed and tooled as directed. Sealant on face of adjacent stone or other materials will not be acceptable.
- B. Joints:
1. Free of air pockets, foreign embedded matter, ridges, and sags.
 2. Tool joints concave.
- C. Apply sealant under pressure with hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed.
- D. Neatly point or tool joint surfaces to provide slightly concave surfaces, free of wrinkles and skips, uniformly smooth and with perfect adhesion along both sides of joint. All joints to be "Dry tooled". Do not use water-wet tool or tooling solutions.
- E. Sealant applied to joints adjacent to mortar joints shall be sanded to achieve texture similar to that of adjacent mortar joint.
- F. Consult sealant Manufacturer regarding the proper method of installing back-up material or joint filler at proper depth in joint to provide specified sealant dimensions. Compress back-up material 25 to 50 percent into the joints as required. Do not apply sealant without back-up materials. Install bond breaker strip between sealant and non-release type back-up material. Three side adhesion is acceptable only for the sealing at joinery of members that are to be rigidly attached to each other by means of screws or welding restricting all movement.
- G. Install back-up rod stock into the joint to avoid length-wise stretching. Rod stock shall not be twisted or braided. Use bond breaker strip in all joints where sufficient room for back-up does not exist.
- H. Surfaces of joints to be sealed must be dry. Do not attempt sealant work on wet surfaces or where frost is present. Consult sealant Manufacturer regarding the procedures for determining acceptable surface conditions.

3.04 CLEANING

- A. Clean adjacent surfaces of sealant as work progresses.
- B. Use solvent or cleaning agent as recommended by sealant Manufacturer.
- C. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

3.05 SCHEDULE

- A. Expansion and Control Joints:
 - 1. Horizontal traffic: Type "A" with gloss reducer.
 - 2. Joints around exterior windows and doors, exterior columns, louvers, masonry, concrete to concrete, steel, wall penetrations, connections, parapet caps, other joints to seal off building from exterior air and moisture: Type "B".
 - 3. Glass (except insulating glass or special coated glass), aluminum, E.I.F.S., Natural Stone, and plastics: Type "C-1".
 - 4. Glass (including insulating glass or special coated glass), aluminum and plastics: Type "C-2".
 - 5. Masonry, and Painted Metals: Type "D".

- B. Non-expanding Joints:
 - 1. Glass (except insulating glass or special coated glass), Aluminum, E.I.F.S., Natural Stone, and Plastics: Type "C-1".
 - 2. Glass (including insulating glass or special coated glass), Aluminum and Plastics: Type "C-2".
 - 3. Masonry, and Painted Metals: Type "D".
 - 4. Concrete to Concrete, Stucco, Masonry, Aluminum, Steel, and Wood: Type "C-1".

- C. Mechanical (ductwork and air conditioning): As specified in Division 23, or Type "D" if not indicated in Division 23.

- D. Plumbing Fixtures and other Wet Areas (around toilet, bath, kitchen fixtures, and food service equipment): Type "E".

- E. Acoustical (acoustical applications where sealant is required): Type "F".

END OF SECTION

SECTION 08 11 13
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Hollow metal steel doors and frames as shown on Drawings and as specified herein.
 - 2. Hollow metal glazing frames as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Section 08 14 00 – Wood Doors, for wood veneer faced doors.
 - 2. Section 08 71 00 – Door Hardware.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing elevations of each door and frame type, typical and details of construction, location and installation requirements for hardware, size and thickness of material.
- B. Fire Rated Doors and Frames:
 - 1. Installation Instructions: Door and frame manufacturer shall clearly identify the hardware products, other materials and work requirements necessary to maintain compliance with UL 10(c) (positive pressure testing) as required by 2012 IBC Section 716.
 - 2. Certification: Submit certification that fire rated doors (including frames and hardware as a unit) will comply with UL 10(c) (positive pressure testing) as required by 2012 IBC Section 716.
- C. Furnish recognized independent test lab certification that products comply with ANSI A250.4.

1.03 DELIVERY AND STORAGE

- A. Deliver welded frames with spreaders and doors with wrappers.
- B. Store doors and frames under protective cover in dry, enclosed spaces at the site. Place doors and frames on non-staining blocking Raise bottoms of doors at least 4 inches high and provide 1/4 inch air space between stacked doors to avoid metal to metal contact and permit air circulation.

1.04 QUALITY ASSURANCE

- A. Doors and frames shall be certified to comply with ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing, and ANSI A250.8, Recommended Specifications for Standard Steel Doors and Frames.

1.05 WARRANTY

- A. Special Warranty: Furnish the following warranty to Owner:
 - 1. Warrant doors against defects in materials and workmanship for a period of 3 years after date of substantial completion of Project.
 - 2. Replacement under warranty shall include removal of the defective door and hardware, hanging, re-installation of hardware, and painting including adjacent finishes if damaged.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish steel doors and frames from one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:
 - 1. Allegion, Steelcraft Doors www.allegion.com
 - 2. ASSA ABLOY, Curries Company, CECO Door Products, Fleming Steel Doors and Frames, Security Metal Products www.curries.com
 - 3. Republic Builders Products www.republicdoor.com
- B. Doors and frames shall be furnished by the same Manufacturer.

2.02 MATERIALS

- A. Doors: Furnish Level, Model and Physical Performance level in accordance with ANSI A250.8/SDI-100.
 - 1. Level: Level 3, 16 gauge at interior doors and Level 4, 14 gauge at exterior doors and at interior locations scheduled on Drawings.
 - 2. Physical Performance level: Level B at interior doors and Level A at exterior doors and at interior doors where indicated on Drawings, or as otherwise scheduled or indicated on Drawings.
 - 3. Model: Model 2, Seamless.
- B. Core: Honeycomb, Polystyrene, Polyurethane, or Vertical steel stiffener core. Core shall be as allowed by UL 10(c) for fire rated doors.
 - 1. Provide polyurethane core at exterior doors.
- C. Steel: ASTM A1008 cold-rolled or ASTM A1011 hot-rolled. Hot-dip galvanized meeting ASTM A653, Grade G60 or Grade A60 galvanized for exterior openings.
- D. Frames: ANSI A250.8/SDI 100, 14 gauge steel at interior frames with 16 or 14 gauge doors and 14 gauge steel at exterior and interior frames with 14 gauge doors, or as otherwise scheduled or indicated on Drawings.
- E. Glazing Beads: Minimum 20 gauge steel.
- F. Rain Drips: Reese A201 A, or equal by Pemko or National Guard.
- G. Paint: Non-lifting, rust-inhibitive grey primer meeting ANSI A224.1, compatible with field finish specified in Section 09 91 00, applied after bonderizing.
- H. Acoustical Insulation (for door frames): As specified in Section 09 81 00.

2.03 FABRICATION- DOORS

- A. Construct hollow metal doors, flush and vision lite types as scheduled on Drawings, in accordance with ANSI A250.8/SDI-100 with core as specified above. Reinforce top and bottom of doors horizontally by 16 gauge steel channels, full width, spot welded to each face at least 3 inches on center. Bevel edge of lock stile.
 - 1. Door Top Edge: Close top of all doors flush as an integral part of the door construction, or by placing end closure channel with web of channel flush with top edge of door (not inverted), or by addition of end cap at top of door, spot welded to each face at least 3 inches on center, filled and dressed smooth.
 - 2. Door Bottom Edge: Close bottom edges of all exterior doors with inverted end closure or end cap to provide channel to accept concealed automatic door bottom or seal.
- B. Door Edge Joint and Treatment: Joints at the edges of doors shall have manufacturer's standard edge construction with factory welded seam, filled and dressed smooth.
- C. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as door faces. Coordinate with hardware schedule:
 - 1. Hinges: 7 gauge by 1-1/2 inch by length of hinge plus 6 inches minimum, securely welded to door edge with a minimum of 6 spot welds.
 - 2. High Frequency Hinges: 12 gauge channel, full length of door edge.
 - 3. Lock Faces and Flush Bolts: 12 gauge steel plate. Provide reinforcement at each door face for locks.
 - 4. All Other Surface Mounted Hardware: 12 gauge steel plate.
- D. Reinforce openings in doors for lites and vents on all sides with 14 gauge steel channel.
- E. Provide solid drip cap at top of exterior out-swinging doors.
- F. Provide non-egress double doors with one-piece Z-astagals of 14 gauge steel unless otherwise indicated or scheduled.
- G. Accurately mortise doors for locks and hinges. Provide adequate box type reinforcement with steel plates welded to the interior reinforcing channels and drilled and tapped. Provide reinforcement for all other items of hardware.
- H. Doors with glass lite openings shall have trim recessed from the face of the door, beveled and attached with screws.
- I. Louvers: Provide sightproof louvers inserted into the panels. Form louver frames of minimum 20-gauge steel. Weld or tenon minimum 24 gauge blades to frame and fasten the entire assembly to the door with moldings. The moldings, when used, shall be an integral part of the louver.
- J. Fire-Rated Doors: Provide fire rated doors investigated and tested as fire door doors, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors. Doors required to meet smoke and draft control assembly requirements shall have labels that identify that the door has been tested and approved for smoke and draft control assemblies (S-label). Construct doors to comply with NFPA Standard No. 80 and UL-10(c).

2.04 FABRICATION - FRAMES

- A. Construct to shapes and sizes shown, meeting various wall thicknesses in accordance with ANSI/SDI-100.
- B. Fully Welded Frames: Continuously weld, fill, grind and dress smooth face frame miters. Continuously back-weld casing, stop, soffit and rabbit.
- C. Mortise, reinforce, drill and tap for standard weight, full mortise template hinges and template strike.
- D. Provide not less than three 18 gauge anchors per jamb, or as shown on Drawings, spaced for maximum stiffness. Provide adjustable 18 gauge floor clips at each jamb, welded to back face of jamb, punched for securing to floor with two spaced anchors.
- E. Make cutouts for required hardware specified under Section 08 71 00, from templates furnished. Reinforce butt cutouts with minimum 8 gauge thick steel plate drilled and tapped and welded in place. When heavy duty hinges are specified, provide high frequency reinforcing at frames for hinges. Coordinate with hardware vendor. Provide strike stops of frames with holes for three rubber door silencers; on double door frames, provide for two silencers per door at head.
 - 1. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as frames. Coordinate with hardware schedule:
 - a. Hinge Cutouts: 7 gauge high frequency steel plate drilled and tapped and fully welded in place top and bottom. 7 gauge at intermediate locations.
 - b. Strikes and Flush Bolts: 12 gauge.
 - c. Surface Mounted Hold-Open Arms and Closers: 7 gauge
 - d. Exit Devices and Corner Reinforcement: 12 gauge
- F. For openings over 42 inches wide and at double openings, reinforce head members full length with a matching profile of 12 gauge steel. Provide anchor at midpoint of door, if practical.
- G. Construct frames for UL labeled doors in accordance with UL requirements and label as scheduled. Frames required to meet smoke and draft control assembly requirements shall have labels that identify that the frame has been tested and approved for smoke and draft control assemblies (S-label).
- H. Rain Drips: Provide rain drip at all exterior hollow metal door frames at exposed exterior walls whether scheduled in hardware sets or not.

2.05 FABRICATION - GLAZING FRAMES

- A. Construct in accordance with applicable parts of door frame Specification and as detailed. Extend partition frames around all four sides of openings.
- B. Provide glazing stops, removable one side and integral from the other side, secured with countersunk flat head Phillips screws spaced at not more than 16 inches on center and 2 inches from corners. Miter stops at corners.
- C. Provide applied muntins for divided lite appearance windows as detailed on Drawings.
 - 1. Muntin Profile: As approved by Architect.

2.06 ELECTRIFIED DOOR HARDWARE

- A. Provide hollow metal frames and doors scheduled to receive electrified hardware with conduit, wiring harnesses, concealed plug connectors and other accessories as necessary to properly connect specified electrified hardware. Coordinate connectors on end of wiring harnesses to plug directly into the hardware, hinge, and other connections.

2.07 FABRICATION TOLERANCES

- A. Allowable Tolerances for Fabrication: As specified in ANSI/SDI-117, Manufacturing Tolerances Standard Steel Doors and Frames.

2.08 PAINTING

- A. Bonderize and prime doors and frames with one shop coat of rust inhibitive primer.

PART 3 EXECUTION

3.01 COORDINATION

- A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
- B. Coordinate Work with frame opening construction, door and hardware installation.
- C. Sequence installation to accommodate required door hardware.
- D. Verify field dimensions for factory assembled frames prior to fabrication.

3.02 EXAMINATION

- A. Verify that project conditions are acceptable before beginning installation of frames.
 - 1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
 - 2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
- B. Do not begin installation until conditions have been properly prepared.
- C. Correct unacceptable conditions before proceeding with installation.

3.03 INSTALLATION

- A. Install metal door frames plumb, level, rigid and in true alignment as recommended in SDI 105 and ANSI/DHI A115.IG, and the following:
 - 1. Cross Site Reveal: Not to exceed 3/16 inch as measured against stop of installed frames and doors. Doors and frames exceeding maximum allowed cross site reveal shall be removed and replaced at no additional expense to Owner.
- B. Install doors and fasten to maintain alignment with frames to achieve maximum operational effectiveness and appearance.
 - 1. Maintain clearances as specified in ANSI A250.8, 2.1.8.
 - 2. Shim as required per NFPA 80, ANSI/A115.IG and SDI 122.

- C. Fill backs of frames solid with mortar at concrete and masonry construction. Hand trowel a stiff mortar to frames. Pumped mortar slurry is not allowed.
- D. Fill backs of frames with full thickness fiberglass batt insulation specified in Section 07 21 00 where indicated at exterior doors, if not otherwise grouted full (masonry construction, and acoustical insulation specified in Section 09 81 00 where indicated at interior doors.
- E. Install fire doors and frames to comply with NFPA 80 and in accordance with Manufacturer's printed instructions.
- F. Prepare and install doors in accordance with ANSI A115 and SDI 122.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's certified door consultant shall inspect fire rated doors (including frames and hardware as a unit) and verify compliance with UL 10C (positive pressure testing) as required by 2012 IBC Section 716. Fire rated doors (including frames and hardware as a unit) which do not comply with UL 10C (positive pressure testing) as required by 2012 IBC Section 716 shall be removed and replaced at no additional cost to Owner.

3.05 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Solid core paint grade wood doors.
 - 2. Pre-fitting wood doors to frames and pre-machining of wood doors for hardware.
- B. Related Sections:
 - 1. Section 08 11 13 – Steel Doors and frames, for hollow metal frames for wood doors.
 - 2. Section 08 71 00 – Door Hardware.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing schedule of doors and types, including the following:
 - 1. Location, size, and hand for each door.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Locations and dimensions of cutouts.
 - 3. Location and extent of hardware blocking and reinforcements.
 - 4. Construction details not covered in Product Data.
 - 5. Fire protection rating for fire rated doors.
 - 6. Submit confirmation of specified duty level in accordance with “Performance Duty Level” per WDMA Bulletin I.S.1A (04).
 - 7. Note discrepancies between the Drawings and door schedules, and the requirements of regulatory and testing agencies.
- B. Product Data: Submit Manufacturer's data showing door construction.
- C. Samples: Before fabrication, submit three (3) corner samples of each type of door to be furnished, showing face, edge, core construction and specified finish for each type specified.
- D. Fire Rated Doors:
 - 1. Installation Instructions: Door manufacturer shall clearly identify the frame, hardware products, other materials and work requirements necessary to maintain compliance with UL 10(c) (positive pressure testing) as required by 2012 IBC.
 - 2. Certification: Submit certification that fire rated doors (including doors, frames and hardware as a unit) will comply with UL 10(c) (positive pressure testing) as required by 2012 IBC.

1.03 QUALITY ASSURANCE

- A. Coordination: Contractor shall be responsible for coordinating and obtaining necessary information from Hardware and Metal Frame Manufacturers. Door Manufacturer shall be responsible for coordinating necessary information received by Contractor from Hardware and Metal Frame Manufacturers in order that doors shall be properly prepared to receive hinges and hardware. Contractor shall provide door supplier with approved frame schedule, hardware schedule, and hardware templates. Furnish to door supplier 60 days prior to desired delivery date of doors.

- B. Fire Rated Wood Doors: Fire doors shall be listed and labeled by a nationally recognized testing and certification agency, in accordance with applicable building codes and shall comply with NFPA 80 for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40 inches above sill) or UL10C.
 - 1. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke “S” Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pairs of doors.
- C. Certification: Provide each fire rated and sound rated door with a label permanently attached at eye level, to the hinge stile or, where interfering hardware such as full length hinges are applied, in a location acceptable to the local Code Authority, indicating the testing agency’s approval for the rating required. Do not cover or conceal label.
- D. Performance Duty Level: Provide doors with the following Performance Duty Level per WDMA Bulletin I.S.1A:
 - 1. Performance Duty Level: Extra Heavy Duty.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Edge Protection:
 - 1. Field Finished Doors: Prior to delivery, seal door edges with an approved clear sealer, compatible with field finish specified.
- B. Delivery:
 - 1. Deliver doors to the jobsite only when proper storage site is available.
 - 2. Store doors in an area having controlled temperature and humidity as recommended by the Window & Door Manufacturers Association (WDMA), AWI and the door manufacturer.
 - 3. Store doors flat on factory pallets, or three full 2 x 4's, one centered and the other two 12 inches from each end. Do not stack doors on end, or on their vertical edge.
 - 4. Protect wood doors from construction activity, dirt, and exposure to sunlight.
- C. Handling:
 - 1. Always handle doors with clean hands or gloves.
 - 2. Do not drag doors across one another.
 - 3. Maintain factory packaging or other means of protection on doors, until date of Substantial Completion.

1.05 WARRANTY

- A. Special Warranty: Furnish the following warranty to Owner:
 - 1. Warrant doors from the date of installation against defects in materials and workmanship. Periods of warranty after date of installation:
 - a. Interior solid core and mineral core: Life of installation.
 - 2. Replacement under warranty shall include removal of the defective door, hanging, installation of hardware, and finishing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish doors of one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements:
1. Marshfield Door Systems www.marshfielddoors.com
 2. Algoma www.algomahardwoods.com
 3. Eggers Industries www.eggersindustries.com
 4. Lynden Door, Inc. www.lyndendoor.com
 5. Oshkosh Architectural Door Company www.oshkoshdoor.com
 6. Graham www.grahamdoors.com
 7. VT Industries, Inc. www.vtindustries.com

2.02 FLUSH DOORS

- A. Cores:
1. Solid Core: Shall conform to ANSI A208.1 LD2, 32 lbs. per cubic foot density. For doors scheduled to receive closers, provide minimum 5 inch solid wood top rail at doors with closers.
 2. Provide supplemental hardwood blocking/reinforcement for locksets, closers, existing devices and other mortised and surface mounted hardware items. Through-bolt attachment is not allowed.
- B. Edge Bandings:
1. Stiles (Dimensions given are minimum sizes allowed after factory trimming to booksize or prefitting).
 - a. Particleboard Core: 1-3/8 inch double banded laminated hardwood stile, laminated strand lumber or structural composite lumber (no finger joints allowed) in inner and outer band to be at least 1/4 inch wide same species lumber as face veneer with the exception of birch doors which will have hard maple stiles.
 2. Rails (Dimensions given are minimum sizes allowed after factory trimming to booksize or prefitting).
 - a. Particleboard Core: 1-1/8 inch minimum mill option hardwood rail.
- C. Face Veneers, Crossbands and Backers: When wood veneer or medium density overlay faces are specified, doors shall be 5 ply (AWI PC-5), made up of a face veneer, crossbanding and a core unit, all securely bonded together utilizing type 1 (fully waterproof) adhesive and the hot press assembly technique. All plies must be placed at right angles to adjacent plies. Face veneers shall have a minimum thickness of 1/50 inch after factory sanding and the individual pieces of veneer forming the face veneer must be spliced or edge glued together. Doors manufactured by cold-pressing 2 or 3-ply pre-manufactured door skins to multiple cores in the same press shall not be acceptable.
1. Provide doors complying with WDMA I.S. 1-A Aesthetic Grade: Custom.
 2. Cross banding shall extend full width and height of door.
 3. Paint Grade: Furnish Medium Density Overlay for paint grade doors. MDO shall meet PS1-74. Overlay shall be factory primed, readily sandable, weatherproof, and carry a Class "B" Fire Rating. Paint grade Birch hardwood and hardwood surfaced doors shall not be considered as meeting this Specification.
- D. Glue: Type 1 (waterproof) for face assembly and Type II (water-resistant) for core assembly per WDMA TM-6 1998 (Adhesive Bond Durability Test Method).

2.03 LABELED FLUSH DOORS

- A. Mineral core flush veneered doors, 5-ply, shall be made up of face veneers, crossbanding, and a core unit securely bonded together utilizing Type I (fully waterproof) adhesive and the hot press assembly technique. Provide matching transom panels where scheduled.
- B. Face Veneers and Crossbanding: Same as specified for non-labeled doors.
- C. Core Unit: Asbestos free, noncombustible mineral composite with a minimum of 28 pounds per cubic foot) density when tested in accordance with ASTM C303, with 10 percent maximum absorption by weight with core in equilibrium at 90 percent relative humidity and 70 degrees F.. Provide flame resistant blocking as required by the hardware schedule. The door listing shall not limit the size or location of such blocking.
 - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
 - b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
 - 3. Provide one lock block 5 inches x 12 inches when a bored unit or mortise lock is to be used and two lock blocks when the door is equipped with an exit device.
 - 4. For doors with closers include 5 inch top rail. Provide wide bottom rails for exit, manual and automatic flush bolts and automatic door bottoms.
- D. Rails: Top 1/2 inch minimum, bottom 1-1/2 inches minimum rail (one or two piece) of flame resistant material - salt free. Securely glue rails to core.
- E. Stiles: Manufacturer's standard for receiving a full mortise hinge. No salt treated components shall be used. UL or WH approved for labeled doors meeting the following performance criteria:
 - 1. 5/16 inch inner stile with 1/4 inch outer stile of matching hardwood, except on Birch, where Maple shall be used.
 - 2. Stiles to conform to "Extra Heavy Duty" WDMA Performance Standards.
- F. Vision Frames: Provide one of the following.
 - 1. Furnish metal vision frames primed for field painting for doors with lites. Frames shall meet AWI standard, UL, or WHI approved.
 - 2. Provide Manufacturer's standard solid wood bead options for Architects approval. Provide Manufacturer's approved, veneer-wrapped wood bead for 45, 60 and 90 minute fire doors.
 - 3. Provide glass and glazing at all doors including fire doors. All doors are to be factory glazed. See Section 08 80 00 for glazing requirements.
- G. Manufacture labeled doors to the required size so as to provide proper clearances without field trimming. Machining of labeled doors must be completed before label is applied to assure the full thickness of the edge bands. Machine fire doors to meet NFPA 80 requirements. Provide channels for concealed exit devices specified in Section 08 71 00 and in conformance with UL requirements.

2.04 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
 - 1. Comply with requirements in NFPA 80 for fire rated doors.
 - 2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Section 08 71 00 - Door Hardware. Wire nut connections are not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Doors shall be hung true and plumb with standard bevel and with uniform 3/32 inch clearance at jambs and head, and 1/2 inch bottom clearance, unless otherwise required. Mortise, drill or otherwise prepare doors for finish hardware specified in Section 08 71 00, Finish Hardware. Pilot drill screw and bolt holes.
- B. Doors that are cut or planed for fitting shall be immediately resealed with a transparent wood sealer. Doors shall operate freely without sticking or binding, without hinge-bound conditions and with hardware installed, properly adjusted and functioning.
- C. Install fire doors and frames to comply with NFPA 80 and in accordance with manufacturer's printed instructions.
- D. Factory Fitted Doors: Align in frames for uniform clearance at edge.

- E. Installation Tolerances:
 - 1. Maximum Diagonal Distortion (Warp): 1/4 inch (6 mm) measured with straight edge or taut string, corner to corner, over an imaginary 42 x 84 inch surface area.
 - 2. Maximum Vertical Distortion (Bow): 1/4 inch (6 mm) measured with straight edge or taut string, top to bottom, over an imaginary 42 x 84 inch surface area.
 - 3. Maximum Width Distortion (Cup): 1/4 inch (6 mm) measured with straight edge or taut string, edge to edge, over an imaginary 42 x 84 inch surface area.
 - 4. Cross Site Reveal: Not to exceed 3/16 inch as measured against stop of installed frames and doors. Doors and frames exceeding maximum allowed cross site reveal shall be removed and replaced at no additional expense to Owner.
- F. Field Finish (Painted Doors): Provide as specified in Section 09 91 00 and in accordance with Door Manufacturer's written instructions.
- G. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.
- H. Adjusting: Adjust doors for smooth and balanced door movement. Re-hang or replace doors that do not swing or operate freely.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes standard steel and stainless-steel construction access doors and frames.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of door and frame indicated including materials and finishes and installation details.
- B. Shop Drawings: Submit Drawings showing sizes, door construction, proposed locations, fabrication and installation details, and relationship with and attachment to wall/ceiling construction where installed.
- C. Samples: Minimum 3-inch x 5-inch Samples of each face material.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage and Protection: Deliver and store items in dry, protected areas. Adequately protect against damage while stored at the site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Framed Access Doors and Frames: Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
 1. Babcock-Davis www.babcockdavis.com
 2. Nystrom Building Products www.nystrom.com
 3. Karp Associates www.karpinc.com
 4. J.L. Industries, Activar Inc. Construction Products Group www.activarcpg.com
 5. Milcor Brand, Hart Cooley Inc. www.milcorinc.com

2.02 ACCESS DOORS

- A. Steel and Stainless Steel Doors: Sizes as shown on the Drawings. Units shall be prime painted steel at painted wall construction and stainless steel in tile and other locations as indicated, in types as required by wall construction, as follows (based on Babcock-Davis):
 1. Non-Rated Access Panels:
 - a. Drywall Walls and Ceilings:
 - 1) All Public and Administrative Spaces: Babcock-Davis B-RW recessed access panel with concealed pivoting rod hinge.

- 2) Mechanical, Utility, Equipment and Other Back-of House Spaces:
Babcock-Davis B-NW access panel.
2. Fire-Rated Access Panels:
 - a. Drywall Walls and Ceilings: Babcock-Davis B-IW, Insulated, Fire-Rated access panel.
 - b. Masonry, Tile Walls, Etc.: Babcock-Davis B-UT, Insulated, Fire-Rated access panel.
- C. Door and Frame: 16 gauge steel. Provide key-operated cylinder locks. At large doors where recommended by the door Manufacturer, provide additional screw driver operated cam locks in sufficient quantity as recommended by Manufacturer to hold door in flush closed position. 16 gauge steel shall be used for door and frame. Type K door shall have concealed spring hinges to allow door to open a minimum of 175 degrees. Size as required or as indicated on the Drawings.
- D. Access Doors in Fire Rated Construction: Door and frame assemblies shall comply with NFPA 80 and the following:
 1. Doors shall be UL or Warnock Hersey labeled and meet self-closing and self-latching requirements for fire rated assembly where they are installed.
 2. Doors shall be UL 1-1/2 hour fire rated when located in a fire rated wall assembly.
- E. Sizes and Locations: Provide doors in quantities and sizes necessary for access to valves, dampers and other devices or equipment requiring periodic access, including locations indicated on drawings (if any).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install access doors in accordance with Manufacturer's directions at locations shown on Drawings or necessary for access to valves, dampers and other devices or equipment requiring periodic access. Do not install panels in locations where frame will extend over transition between two separate wall or ceiling finish materials (i.e. tile to gypsum board).
- B. Install fire-rated access doors and frames to comply with NFPA 80 and Manufacturer's printed instructions for a fire-rated assembly.
- C. Install plumb and level, true to line.
- D. Remove PVC protectant film off of hatch covers and frames following application of adjacent final finishes (painting, etc.) for wall and ceiling units and following concrete pouring and finishing operations for floor/sidewalk mounted units.

3.02 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 08 36 13

SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.01 DESIGN / PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Design doors to meet windload of 20 psf.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings indicating type of doors, operation, finishes and installation details.
- B. Samples: Submit 2 samples showing specified finish.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
- C. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.05 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.06 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.07 WARRANTY

- A. Provide manufacturer's standard 10 year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
 1. Overhead Door Corp. www.overheaddoor.com
 2. Ceco/Windsor Door www.cecodoor.com
 3. Clopay Corp. www.clopaydoor.com
 4. Raynor www.raynor.com
- B. Specifications are based on products as manufactured by Overhead Door Corp.

2.02 ALUMINUM OVERHEAD DOORS

- A. Doors: Overhead 521 Series aluminum sectional glass overhead doors.
- B. Door Panels: 0.05 inch aluminum with 6063-T6 extruded aluminum stiles and rails.
- C. Finish: Polyester powder coated finish color indicated on Drawings.

2.03 INSULATED PANELS

- A. Aluminum faced (both sides) 3/8 inch thick EPS solid panels. Color to match frames.

2.04 VISION LITES

- A. Provide fully glazed door sections with EDPM or PVC frame. Provide glazed panels in number of rows (panels) indicated on Drawings.
- B. Glazing: 1/2 inch insulated thermal units, Solarbronze tinted glass with Low-E coating on No. 2 surface to match insulating glass units for building as specified in Section 08 80 00.

2.05 TRACK SYSTEM AND HARDWARE

- A. Provide overhead section door track system with track configuration and overhead clearance as indicated on Drawings.
- B. Provide 3 inch tracks.
- C. Roller Brackets and Hinges: Heavy steel, galvanized. Rollers to have ball bearings with case hardened inner and outer races.
- D. Heavy-duty springs.
- E. Guides: Steel angles or sections.
- F. Lock: Keyed lock with interlock switch for automatic operator.

2.06 WEATHERSTRIPPING

- A. Weatherstripping:
 - 1. EPDM bulb-type strip at bottom section.
 - 2. Flexible Jamb seals.
 - 3. Flexible Header seal.

2.07 OPERATION

- A. Electric Motor Operation: Overhead Door Model RSX Jackshaft, jamb mounted, UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
 - 1. Entrapment Protection: Required for momentary contact, includes radio control operation.
 - a. Pneumatic sensing edge up to 18 feet wide. Constant contact only complying with UL 325/2010.
 - 2. Control Panels: Custom fabricated flush mounted control panels provided by the Electrical Contractor which includes three push-buttons (open, stop, close) for each door and inter-tied between multiple control panels for each door.
 - a. Refer to Bay Doors Wiring Diagram located on Drawings for further description and interface requirements of Control Panels.
 - b. Control Panel Locations: Multiple locations as indicated on Drawings.
 - c. Provide door operator control panel with interface with multiple Control Panels as indicated. Provide interface to closure loops, bay exhaust controls and other operating features as required for the Project.
 - 3. Options: Provide Auxiliary Output Module and Monitored Edge Interface Module.
 - 4. Special Operation: Provide in-floor vehicle detector operation, radio control operation with transmitters, and door timer operation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Do not begin installation until openings have been properly prepared.
 - 2. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
 - 3. Verify electric power is available and of correct characteristics.
 - 4. Notify Architect of unsatisfactory preparation before proceeding.
 - 5. Commencement of Work will be construed as acceptance of subsurfaces.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Doors are to be installed by the Manufacturer or authorized representative in strict accordance with Manufacturer's printed instructions.

- B. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- C. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- D. Anchor assembly to wall construction and building framing without distortion or stress.
- E. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- F. Fit and align door assembly including hardware.
- G. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- H. Upon completion of installation, including Work by other Trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for entire perimeter.

3.04 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames and glass.
- C. Remove temporary labels and visible markings.
- D. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

3.05 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08 37 13
FOUR-FOLD DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Four-fold metal doors with surface mounted tube frames and overhead mounted electro-mechanical operators.

1.02 SUBMITTALS

- A. Product Data for each type of product specified consisting of manufacturers technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.
 - 1. Include product data for safety equipment including hinge guards, upgraded safety edges, upgraded phot eyes, upgraded presence sensor and horn / strobe / verbal annunciator.
- B. Submit Shop Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.
- C. Reference list including five (5) successful installations of this type of door within the past two (2) years.

1.03 QUALITY ASSURANCE

- A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual".
- B. Door manufacturer shall have at least 10 years experience in manufacturing door of type specified for emergency vehicle applications.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with manufacturer's instructions.

1.05 WARRANTY

- A. Warranty: Door manufacturer shall provide written guarantee against defects in material and workmanship for a period of three (3) years from date of substantial completion and acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of the following manufacturer, except as otherwise approved by the Architect, subject to compliance with specifications requirements:
 - 1. Door Engineering and Manufacturing www.doorengineering.com.
- B. Basis of Design: Drawings and Specifications are based on Four-Fold doors as manufactured by Door Engineering and Manufacturing products of design and configuration indicated on Drawings.

2.02 MATERIALS

- A. Tube Steel: ASTM A513 and ASTM A500.
- B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011 hot-rolled steel sheet.
- C. Hardware: Manufacturer's standard components.
- D. Fasteners: Zinc-coated steel.

2.03 FOUR-FOLD DOORS

- A. Model: Door Engineering and Manufacturing Four-Fold doors with recessed infill panels and glazed panels as indicated on Drawings.
- B. Construction: Door framing shall be minimum 14-gauge structural steel tube with 14-gauge sheet steel on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
- C. Insulation: Fiberglass (or polyisocyanurate) as standard with the manufacturer.
- D. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6 x 4 x 0.25, designed to anchor to masonry wall construction or weld to steel structure as indicated on Drawings. All hinges, track supports and operator supports shall be factory attached.
- E. Factory Finish: Factory primed with manufacturer's standard structural primer for field finish painting as specified in Section 09 91 00.
- F. Operating Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings each. Jamb hinged shall be gusseted. Fold hinges shall be dual shear with two thrust bearings each. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum 3/4 inch diameter hardened steel.

- G. Weatherstripping: Material shall be adjustable and readily replaceable and provide a weather-tight installation. Weatherstripping at center and bottom shall be 1/16 inch cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel.. Weatherstripping at sill shall include two (2) 1/16 inch cloth inserted neoprene sweeps with aluminum retainer. Retainer shall be attached to the door with adhesive
- H. Perimeter Weatherstripping: Provide jamb and head weatherstripping of 1/16 inch cloth-inserted neoprene bulb (or closed cell neoprene).
- I. Vision Panels Glazing: 1/2 inch insulated thermal units, Solarbronze tinted glass with Low-E coating on No. 2 surface to match insulating glass units for building as specified in Section 08 80 00.

2.04 OPERATOR

- A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. Door shall be operated with connecting rods attached to the rotating drive arm on the operator and control arms attached to the jamb door sections and to the door lintel. Connecting rods shall be positive drive, keeping the door under firm control at all times. Connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts. Exterior mounted operators shall have a formed weather hood.
- B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.
- C. Operator shall include a formed hood enclosing the motor, gearboxes and limit switches.
- D. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/260/480 VAC, 60 Hertz operation.
- E. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Field verify existing incoming electrical service requirements.
 - 1. Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
 - 2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
 - 3. Where incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor.
 - 4. Enclosure shall be NEMA 4 with disconnect switch.
 - 5. Pushbuttons for each door shall have one (1) momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
 - 6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
 - 7. Hinge Guards: Provide manufacturer's standard plastic hinge guards.

7. Safety edges: Provide manufacturer's upgraded Fail-Safe bump edges on leading edge of all doors to reverse door upon contact with obstruction. Provide wireless safety edge transmitters with low battery alarm.
 8. Photo Eyes: Provide manufacturer's upgraded Exterior Light Curtain Photo Eyes, jamb mounted, thru-beam type photo eyes, NEMA 4 rated, for each door, for continuous protection from the floor to 72 inches AFF to senses both objects and personnel near the floor as well as higher clearance vehicles.
 9. Presence Sensor: Provide manufacturer's upgraded BEA LZR-Widescan Presence Sensor with 3 independent sensing fields for protection from both opening and closing. Overhead mounted at each door.
 - a. Pre-Close Field: Scans door path prior to closing.
 - b. Pre-Open Path: Scans door path prior to opening.
 - c. Motion Field: Senses objects approaching during the closing door motion.
 10. Horn / Strobe / Verbal Annunciator: Provide manufacturer's optional Horn / Strobe / Verbal Annunciator which provide warning prior to automatic closing of door and during both the opening and closing motion.
 11. Radio controls: Provide one (1) radio receiver and (2) single button remote transmitters per door. Remotes shall open and close doors with single button. Coordinate make and model to with Owner's requirements.
 12. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.
- F. Door Operation:
1. Remotes shall open and close doors.
 2. Automatic Function: Doors shall time out and close once the exterior photo eye is activated and cleared. Provide Auto/Manual switch. In Auto, the remotes shall open doors only. In Manual, the remotes shall open, stop and close the doors and the auto close function shall be disabled.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.
- B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.
- C. Test and adjust all operators, controls, and safety equipment for proper operation.

3.02 ADJUSTING AND CLEANING

- A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

- B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Aluminum doors and window wall frames (storefront) for exterior and interior locations.
 - 2. Operable windows installed within aluminum window wall frames.
- B. Related Sections:
 - 1. Section 08 71 00 – Door Hardware
 - 2. Section 08 80 00 – Glazing

1.02 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Window wall framing system shall provide for flush retained glazing on all sides without projecting stops, with glass set in the center of the frame.
 - 2. Framing system shall be suitable for outside or inside glazing.
 - 3. System shall be either screw spline, shear block or a compensating/stick system.
 - 4. Operable Windows: In addition to requirements shown or specified, comply with applicable provisions of AAMA Windows and Sliding Glass Doors Manual for design, materials, fabrication and installation of component parts.
 - a. Design Requirements: Arcadia N200 Series (non-thermal) Heavy Commercial Hopper Windows 2-inch depth. Hinged compression sealed aluminum windows, suitable for outside or inside glazing.
- B. Performance Requirements: Window wall.
 - 1. Limit air leakage through assembly to 0.06 CFM/min/sq. ft. of wall area at 6.24 PSF as measured in accordance with ASTM E283.
 - 2. Water leakage: None, when measured in accordance with ASTM E 331 with a minimum static test pressure of 10 psf.
 - 3. Limit deflection to L/175 with a maximum of 3/4 inch when subjected to 25 psf wind load design pressure acting inward and outward.
 - 4. System shall not deflect more than 1/8 inch at the center point of a horizontal member, or more than 1/16 inch at the center of members located directly above operable doors and windows, once deadload points have been established.
 - 5. System shall accommodate expansion and contraction movement due to surface temperature differential of 180 degrees F.
 - 6. Seismic requirements shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
 - 7. Performance requirements for air and water leakage are not applicable to interior units.
- C. Performance - Aluminum Doors (Swinging): Resistance to corner racking shall be tested by the Dual Moment Load test as follows:
 - 1. Test section shall consist of standard top door corner assembly. Side rail section shall be 24 inches (600mm) long and top rail section 12 inches long.
 - 2. Anchor "top rail" positively to test bench so that corner protrudes 3 inches beyond bench edge.

3. Anchor a lever arm positively to side rail at a point 19 inches from inside edge of top rail. Attach weight support pad at a point 19 inches from inner edge of side rail.
 4. Test section shall withstand a minimum load of 200 pounds on the lever arm before reaching the point of failure, which shall be considered a rotation on the lever arm in excess of 45 degrees.
- D. Performance Requirements – Operable Windows: Each assembly shall be tested by a recognized testing laboratory or agency in accordance with specified test methods.
1. Conformance to FW-LC25, C-LC25, AP-LC25 specifications in AAMA/NWWDA 101/I.S. 2/A440-8.
 - a. Air Infiltration: Accordance with ASTM E283 at a static air pressure difference of 1.6 psf. Air infiltration shall not exceed .30 cfm per square foot.
 - b. Water Resistance: Accordance with ASTM E331/ASTM E547 at a static air pressure difference of 3.8 psf. No water leakage.
 - c. Uniform Load Structural: Aluminum window systems comply with AAMA/WDMA/CSA 101/I.S.2/A440-08, Voluntary specifications for aluminum windows. Guidelines for specified AW rated product.
 - d. Component Testing: Accordance with procedures described in AAMA/NWWDA 101/I.S. 2/A440-08.
 - e. Forced Entry Resistance: All windows shall conform to CAWM 301-90.
 - f. Condensation Resistance Test: (CRF) when tested in accordance with AAMA 1503.1-88, the condensation resistance factor shall not be less than 51.
 - g. Thermal Movements: Allow thermal movement resulting from the following maximum change (range) in ambient temperature.
 - 1) 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.03 SUBMITTALS

- A. Submit product data, shop drawings and samples in accordance with Section 01 33 00.
1. Product Data: Submit 2 copies of Manufacturer's Specifications, recommendations and standard details for aluminum doors, frames and components of the Work. Include manufacturer's installation manual.
 2. Shop Drawings:
 - a. Include wall elevations at 1/2 inch scale, and full-size detailed sections of every typical composite member.
 - b. Show anchors, joint system, expansion provisions, end dams, water diverters and other components not included in Manufacturer's standard data.
 - c. Include glazing details.
 3. Samples:
 - a. Submit 2 samples of each required aluminum finish on 12-inch long extrusions or 6-inch square sheets of the alloys to be used for the Work.
 - b. Where normal color and texture variations are to be expected, include 2 or more units in each Sample, to show the range of such variations.
 - c. Samples will be reviewed by Architect for color and texture only.
 - d. Architect reserves the right to require samples of typical fabricated sections, showing joints, exposed fastenings (if any), quality of workmanship, hardware and accessory items, before fabrication of the Work proceeds.

1.04 QUALITY ASSURANCE

- A. Standards: Except as otherwise indicated, the requirements for aluminum doors and frames, and the terminology used in this Section, are those of NAAMM, AAMA and AA and in particular, those of the "Entrance Manual" by NAAMM.
- B. Regulatory Requirements:
 - 1. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act of 1992 Administrative Rules (AzDAAG)

1.05 PROJECT/SITE CONDITIONS

- A. Field Measurements:
 - 1. Whenever possible, check the actual openings in the construction Work by accurate field measurement before fabrication, and show recorded measurements on final shop drawings.
 - 2. Coordinate fabrication schedule with construction progress as directed and avoid delays of the Work.
 - 3. Where necessary, proceed with fabrication without field measurement, and coordinate installation tolerances to ensure proper fit of units.

1.06 WARRANTY

- A. Warrant entire system of aluminum entrance doors and frames against leaks or other defects for a period of ten (10) years.
 - 1. Defective materials and workmanship are hereby defined to include, but are not limited to, evidence of:
 - a. Penetration of water into the building through fixed glazing and framing components.
 - b. Air infiltration exceeding specified limits.
 - c. Structural failure of components resulting from forces within specified limits.
 - d. Failure of insulated glass units.
 - e. Cracking, crazing, flaking, of coatings or opacifiers on glass.
 - f. Secondary glass damage and/or damage due to falling components.
 - g. Adhesive or cohesive failure of sealant.
 - h. Crazing on surface of non-structural sealant.
 - i. Non-structural sealant hardening beyond Shore A durometer 50 or softening below 20.
 - j. Failure of operating parts to function normally.
- B. Warrant aluminum finish against excessive fading, excessive non- uniformity of color or shade, cracking, peeling, pitting or corroding (all within the limits defined). Warranty shall include replacement at no charge (material and labor) for a period of five (5) years beginning on the date of final acceptance.
- C. Upon notification of defects within the warranty period, make the necessary repairs and replacements at the convenience of the Owner. Repairs and replacements shall include resultant damage to adjacent materials, systems and equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as otherwise approved by the Architect, subject to compliance with specifications requirements:
1. Arcadia, Inc. www.arcadiainc.com
 2. EFCO. www.efcocorp.com
 3. Kawneer Co. www.kawneer.com
 4. Oldcastle Building Envelope www.oldcastlebe.com
 5. CRL - US Aluminum Corp. www.crlaurence.com

2.02 MATERIALS

- A. Framing members, transition members, mullions, adapters, and mountings: Extruded 6063 T5 aluminum alloy (ASTM B221 - Alloy G.S. 10aT5).
- B. Screws, miscellaneous fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM B633. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum.
- C. Glazing gaskets: Elastomeric extrusions as required to provide specified performance. PVC glazing gaskets are not acceptable.
- D. Steel Sections: ANSI/ASTM A36; shaped to suit mullion sections.
- E. Glass: As specified in Section 08 80 00.
- F. Sealant: Silicone sealant in accordance with Section 07 92 00.
- G. Shop and Touch-Up Primer for Steel Components: SSPC 15, Type 1, red oxide.
- H. Touch-Up Primer for Galvanized Steel Surfaces: SSPS 20, zinc rich type.
- I. Operable Windows Hardware and Accessories:
1. Provide heavy-duty four bar hinges shall be stainless steel only, with asymmetric end caps, and adjustable limit stops. Lock and latches cast white bronze, US-25D finish.
 2. Weatherstrip EPDM bulb type conforming to ASTM D2000 AA515 and shall be keyed into extruded grooves.
 3. Back glazing two-sided adhesive, 15 lbs./cu. ft. density, polyethylene tape. Glazing wedges shall be EPDM or Santoprene.
 4. At operable windows provide screens made of extruded aluminum frame and screened with either 18 x 14 aluminum or fiber mesh.

2.03 COMPONENTS

- A. Sizes and Profiles: The required sizes for doors and frame units, and profile requirements, are shown, and are based on Aluminum Entrance and Storefront Frames indicated on Drawings as manufactured by Arcadia as follows:
1. Aluminum Entrance and Storefront Frames: Arcadia AG451 Series.

2.04 FABRICATION

- A. General:
1. Weld by methods recommended by the Manufacturer and AWS to avoid discoloration at welds.
 2. Grind exposed welds smooth and restore mechanical finish.
 3. Remove arises from cut edges and ease edges and corners to a radius of approximately 1/64 inch.
 4. Conceal fasteners, wherever possible, except as otherwise shown.
 5. Maintain continuity of line and accurate relation of planes and angles.
 6. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.
 7. Reinforce the Work as necessary for performance requirements, and for support to the structure.
 8. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion.
 9. Separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.
- B. Frames:
1. Fabricate tubular assemblies as shown, with either welded or mechanical joints in accordance with Manufacturer's standards, with concealed fasteners wherever possible.
 2. Provide members of the size, shape, and profile shown.
 3. Reinforce internally with steel channel shapes as necessary to support the required loads. Secure vertical steel at head and sill as necessary for structural performance.
 4. Weatherstripping: Provide compression weatherstripping on door-contact face of door stops on exterior door frames and/or other frames where indicated.
 5. Glass framing members shall provide for flush glazing with through sight lines, without projecting stops for glass thicknesses noted on drawings or as specified in Section 08 80 00.
 6. Provide glazing system for frames to receive lights. Design system for replacement of glass.
 7. System shall provide resilient settings for glass by use of elastomeric extrusions as required to provide specified performance. PVC glazing gaskets are not acceptable.
 8. Fabricate frame assemblies for exterior walls with end dams, flashing and weeps to drain penetrating moisture to exterior.
 9. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
 10. Allow for thermal expansion of exterior units.
 11. Include flashings in conjunction with components as detailed, finished to match.
- C. Doors (Swinging)
1. Materials: Sections shall be extruded for 6063-T5 aluminum alloy (ASTM B221 - Alloy G.S. 10A T5).
 2. Fasteners, where exposed, shall be aluminum, stainless steel or plated steel. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum.
 3. Glazing gaskets shall be TPE or EPDM elastomeric extrusions.
 4. Major portions of the door stiles shall be 0.125 inch in thickness and glazing molding shall be 0.050 inch thick.

5. Construction: Provide type as indicated on Drawings, conforming to one or both of the following:
 - a. Medium Stile:
 - 1) Vertical Stile: 3-1/2 inches.
 - 2) Top Rail: 3-1/2 inches.
 3. Bottom Rail: 10 inches
 - b. Wide Stile:
 - 1) Vertical Stile: 5 inches.
 - 2) Top Rail: 5 inches.
 3. Bottom Rail: 10 inches
 - c. Thickness of stiles and rails: 1-3/4 inches.
 - d. Corner construction: Fillet weld and mechanical clip fastening.
 6. Door shall be weatherstripped on 3 sides with metal-backed pile cloth installed in door and/or frame. Provide an integral adjustable (uninterrupted) dual weathering at meeting stiles of pairs of doors.
 7. Hardware: Provide the following items:
 - a. Weatherstrip and door bottom/sweep: Aluminum Door Manufacturer's standard.
 - b. Balance of Door Hardware: As specified in Section 08 71 00 and as scheduled on Drawings.
- D. Operable Windows:
1. Frame components mitered, reinforced extruded corner key, hydraulically crimped, and "cold welded."
 2. All ventilator extensions tubular, each corner mitered, reinforced extruded corner key, hydraulically crimped, and "cold welded."
 3. All corners weather sealed with an elastomeric sealant.
- E. Flashings and Miscellaneous Trim:
1. Provide interior sills, exterior sill (or subsills) with end dams, closures, flashings, break metal covers, trim and other elements in conjunction with or adjacent to storefront system as required for watertightness and aesthetics. If sill frame does not provide means for conducting water out of the aluminum frame systems, then suitable flashings to ensure that water is conducted out of system shall be provided. Provide water diverters at ends of the horizontal mullion glazing pockets to drain water down the vertical mullion/hamb glazing pockets to sill can or flashing.
 2. Fabricate miscellaneous trim from 0.060-inch-thick minimum aluminum (break metal) finished to match other components, except fabricate interior and exterior sills(or subsills) from 0.075-inch-thick minimum extruded aluminum (unless the sill or subsill is supporting the weight of the system and then a 0.125-inch thick minimum extruded aluminum shall be provided).
 3. Flashings and sill can, in conjunction with mechanically fastened end dams and/or water diverters shall direct water entering the system to the outside of the building and shall not depend solely upon sealants.
- E. Hardware Installation at Factory:
1. Cut, reinforce, drill and tap frames as required to receive hardware except do not drill and tap for surface-mounted items until the time of installation at the Project Site. Comply with Hardware Manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
 2. Install hardware, except surface-mounted hardware, at fabrication plant. Remove only as required for final finishing operations, and for delivery and installation of the Work at the Project Site.

- F. Aluminum Finishes:
 - 1. Prepare the aluminum surfaces for finishing in accordance with the aluminum producer's recommendations and standards of the finisher or processor.
 - 2. Process components of each assembly in a manner to attain complete uniformity of color.
 - 3. Finish: Color anodized, Architectural Class 1 anodic coating conforming to Aluminum Association Designation AA-M-12 C22 A42/44.
 - a. Basis of Design Color: Arcadia Champagne anodized AB-2, or as otherwise approved by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Comply with Manufacturer's Specifications and recommendations for the installation of aluminum entrance and storefront frames.
 - 1. Furnish necessary material, labor, and equipment for the complete installation of the following: glass framing, vertical and horizontal mullions, transitional members connecting these components, adapters and mountings for trim moldings and facing materials.
 - 2. Set units plumb, level and true in line, without warp or rack of frames, doors or panels.
 - 3. Anchor securely in place.
 - 4. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
 - 5. Set sill members and other members in a bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction.
- B. Comply with Section 07 92 00 for sealants, compounds, fillers and gaskets to be installed integrally with aluminum entrances and storefronts.
 - 1. Seal joints in aluminum entrance and storefront in a concealed manner, unless exposed sealant is indicated.
- C. Comply with Section 08 80 00 and Aluminum Storefront Manufacturers printed instructions for installation of glass shown to be glazed into aluminum entrances and storefront.
- D. Dimensions indicated are based on an assumed design temperature of 70 degrees F. Take into account the ambient temperature range at the time of fabrication and erection.
- E. Cut and trim component parts of the aluminum entrance and storefront during erection only with the approval of the manufacturer or fabricator and in accordance with his recommendations. Do not cut through reinforcing members. Restore finish completely to protect material and remove evidence of cutting and trimming. Remove and replace members where cutting or trimming has impaired strength or appearance.

- F. Do not erect members which are warped, bowed, deformed or otherwise damaged to such extent as to impair strength or appearance. Remove and replace members damaged in the process of erection.

3.03 FIELD QUALITY CONTROL

- A. When requested by Architect or Owner, test each storefront system installed for water leaks in accordance with AAMA 501.2.03. Provide written certification that installed storefront framing systems pass.

3.04 CLEANING

- A. Clean aluminum surfaces promptly after installation of frames, exercising care to avoid damage of the protective coating.
- B. Remove excess glazing and sealant compounds, dirt, and other substances.

END OF SECTION

SECTION 08 42 29.39

LOW-ENERGY SWING ENTRANCE AUTOMATIC DOOR OPERATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Low-energy electro-mechanical swing door operators for aluminum swing entrance doors.
 - 2. Activation controls.
- B. Related Sections:
 - 1. Section 08 41 13 – Aluminum Entrances and Storefronts, for aluminum entrance doors to receive automatic swing door operators.
 - 2. Section 08 71 00 – Door Hardware.

1.02 SYSTEM DESCRIPTION

- A. Complete package shall consist of electro-mechanical door operator, linkages, and activation controls for application to aluminum entrance doors.
- B. Performance Requirements:
 - 1. Automatic door equipment shall accommodate heavy pedestrian traffic and a minimum door weight of 125 lbs., but not less than weight of doors specified to be automatically operated.
 - 2. Operators shall open and close doors and maintain them in fully closed position when subjected to design wind speed of the Project.
 - 3. Opening/Closing Force: Force required to prevent door from opening or closing shall not exceed 15 lbf. Applied 1 inch from the latch edge of the door at any point in the opening or closing cycle, in accordance with ANSI A156.19.
 - 4. Opening Force (exterior doors): 15 lbf. or less to release latch, 30 lbf. or less to set door in motion, and 15 lbf. or less to fully open door when power is off, in accordance with ANSI A156.19.
 - 5. Closing Time: Not less than 4.5 seconds in accordance with ADA guidelines.
 - 6. Operating Temperature Range: minus 30 degrees F to plus 130 degrees F.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, recommendations and standard details for operators, activation controls and other components, maintenance and operating manuals, and installation instructions. Furnish specialized tools required for maintenance and adjustment of units.
- B. Shop Drawings:
 - 1. Include elevations at 1/2 inch scale showing installed units.
 - 2. Show fasteners and anchorages details, location of components, adjacent construction interface, location of door activators, dimensions, and preparation requirements for frames and doors.
- C. Samples: Submit sample of required aluminum finish on 12 inches long extrusions or 6 inch square sheets of the alloys to be used for the work.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the following:
 - 1. ANSI A156.19 "Power Assist and Low-Energy Power Operated Doors."
 - 2. UL 325.
 - 3. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 4. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 5. 2010 ADA Accessibility Guidelines (ADAAG).
 - 6. The Arizonans with Disabilities Act of 1992 Administrative Rules (AzDAAG)
- B. Installer Qualifications: Manufacturer's authorized representative for installation and maintenance of the type of units required.

1.05 PROJECT/SITE CONDITIONS

- A. Coordination: Coordinate automatic door operators and activation devices with aluminum doors, frames and hardware and other construction as required for mounting of activation devices.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Use means necessary to protect automatic door operators before, during and after installation and protect the installed work of other trades.
- B. In the event of damage, immediately make repairs necessary to the approval of and at no additional cost to the Owner.

1.07 WARRANTY

- A. Warrant entire system of automatic door operators and activation components against defects for a period of three (3) years.
 - 1. Defective materials and workmanship are hereby defined to include, but are not limited to, evidence of:
 - a. Structural failure of components resulting from forces within specified limits.
 - b. Failure to fulfill other specified performance requirements.
 - c. Failure of operating parts to function normally.
- B. Warrant aluminum finish against excessive fading, excessive non- uniformity of color or shade, cracking, peeling, pitting or corroding (all within the limits defined). Warranty shall include replacement at no charge (material and labor) for a period of twenty (20) years beginning on the date of final acceptance.
- C. Upon notification of defects within the warranty period, make the necessary repairs and replacements at the convenience of the Owner. Repairs and replacements shall include resultant damage to adjacent materials, systems and equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as otherwise approved by the Architect, subject to compliance with specifications requirements:
1. Besam, Inc. www.besam.com
 2. Dorma Architectural Hardware www.dorma-usa.com
 3. Horton Automatics Division of Overhead Door Corporation www.hortondoors.com.
 4. Stanley Access technologies; Div. Of the Stanley Works www.stanleyworks.com.

2.02 COMPONENTS

- A. Aluminum Entrance Doors: As specified in Section 08 41 13.
- B. Low-Energy Door Operator: Provide manufacturer's standard door operator of size recommended by manufacturer for door size, weight and operation indicated, and complying with the following:
1. Type: Low-energy electromechanical type operator, power open, spring close, self-contained overhead unit with electric motor, reduction or helical gear drive, door arm and linkage assembly, fully-lubricated sealed ball-bearings, springs and other components as standard with manufacturer for type of unit required.
 2. Spring Closing: Spring energy closing. Closing speed controlled by gear train and dynamic braking action of electric motor.
 3. Manual Operation: Operator shall function as a manual door closer in the direction of swing with or without electrical power.
 4. Adjustment Features: Operator shall be fully adjustable without removing entrance door(s), including adjustable speed, adjustable time delay for length of time doors remain open and automatic door re-open if stopped while closing.
 5. Housing: Die-cast aluminum, lubricant filled.
 6. Mounting: Concealed header mounted.
 7. Header: Manufacturer's standard header box with structural integrated end caps, fabricated of 6063-T5 aluminum extrusions. Provide structural sections of minimum .025 inch aluminum. Provide full length removable cover for access to operator and electronic control box.
 8. Linkage Assembly: Manufacturer's standard linkage assembly for type of operator, door and door hinges/pivots specified, providing positive control of door through entire swing.
 9. Mechanical parts shall either be field repairable or replaceable without the use of rebuilt components.
- C. Activation Device: Provide manufactures standard push plate switch for wire connection to door controller, and as follows:
1. Push Plate: 4 inch or 4-1/2 inch square or round wall plate with handicap logo and "Press to Operate Door" engraved on plate.
 2. Designed for mounting on single or double gang electrical box.
 3. Mounting Location: Aluminum window wall mullion location indicated on Drawings.
 4. Normally open momentary contact type switch.
 5. Concealed socket mounting screws.
- D. Aluminum Finishes: As specified in Section 08 41 13.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.
 - 1. Coordinate conduit and wiring with Division 26 - Electrical.
 - 2. Coordinate installation with aluminum entrance doors specified in Section 08 41 13.

3.02 INSTALLATION

- A. Install units in compliance with manufacturer's printed instructions and approved Shop Drawings.
 - 1. Set units plumb, level and true in line, correctly positioned in relation to door frames and doors to be operated.
 - 2. Anchor securely in place using fasteners supplied by automatic operator manufacturer.
 - 3. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- B. Door Activation Devices: Install door activation push-plate controls on each side of door opening as detailed and at locations indicated in compliance with manufacturer's printed instructions and to comply with referenced standards.
- C. Adjust operating components for speed, opening force, delay and other adjustments to comply with referenced standards.
- D. Connect electrical operator and activation devices in accordance with the requirements of Division 26 - Electrical.

3.03 INSTRUCTION

- A. At substantial completion of Project, instruct Owners personnel in the proper use adjustment and maintenance of automatic door operators and activations devices.

3.04 ADJUSTMENT AND CLEANING

- A. Perform final adjustment of operating components for speed, opening force, delay and other adjustments to comply with referenced standards after repeated operation just prior to final occupancy of Project.
- B. Remove and replace or repair where acceptable to Architect, units that do not comply with requirements.
- C. Clean aluminum surfaces promptly after installation, exercising care to avoid damage of the protective coating.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Furnish and install Door Hardware as shown on Drawings and as specified herein, unless specifically excluded and specified in other Sections.
- B. The Work of this Section shall be the total responsibility of one firm herein identified as the Supplier/Installer, and shall cover the complete coordination of related work in other Sections. After bidding the Project, the General Contractor shall secure a minimum of three (3) competitive proposals from qualified Suppliers/Installers for the Work described herein. Proposals shall be provided to the Owner/Architect for review and approval.
- C. Door Hardware includes items known commercially as builders hardware that are required for swing, sliding and folding doors, gates and miscellaneous items as indicated, except special types of unique and non-matching hardware specified in the same Section as the door and door frame. Types of items in this Section include, but are not necessarily limited to the following:
 - 1. Butt Hinges
 - 2. Continuous hinges
 - 3. Pivots
 - 4. Lock and latch sets
 - 5. Door Bolts
 - 6. Exit devices
 - 7. Push/pull units
 - 8. Overhead closers and holders
 - 9. Door trim units
 - 10. Protection Plates
 - 11. Bi-fold door hardware
 - 12. Drip strip
 - 13. Automatic operators
 - 14. Electric locking devices
 - 15. Security devices
 - 16. Access control devices

1.2 SYSTEM DESCRIPTION

- A. General Requirements: While the Hardware Schedule is intended to cover doors and other movable parts of the building and establish a type and standard of quality, examine Drawings and Specifications and furnish proper hardware for openings whether listed or not. Hardware must meet applicable handicapped access standards, ordinances and codes. Omissions or corrections in hardware groups shall be brought to the attention of the Architect prior to bid opening. No extras will be allowed for omissions, changes or corrections necessary to facilitate proper installation.
- B. If an item is not specified but will be required in a similar situation, furnish equal hardware to that specified for similar locations if practicable. If no similar location is specified, then use hardware in keeping with that specified.

- C. The Work of this Section shall be the total responsibility of one firm herein identified as the Supplier/Installer, and shall cover the complete coordination of related work in other Sections.

1.3 SUBMITTALS

- A. General: Submittals requirements are specified in Section 01 3300, Submittal Procedures.
- B. Materials List: As soon as practical after award of Contract, submit a complete listing of materials to be furnished. Submit in quantities as directed by the Architect, showing each item proposed for installation use and quantities to be furnished. Supplier/Installer shall state in their submittal the approximate delivery date to Contractor after receipt of reviewed submittals.
- C. Product Data: Submit manufacturer's technical information for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and maintenance of operating parts and finish.
- D. Hardware Schedule: Submit final Hardware Schedule in manner indicated below. Hardware Schedules are intended for coordination of Work. Hardware Schedule shall include a summary of individual items of hardware and related material used on the project, complete with the name of the manufacturer of each item. The Hardware Schedule shall be prepared in vertical format.
 - 1. Final Hardware Schedule Content: Based on builders hardware indicated, organize Hardware Schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Catalog number, type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, codes, etc., contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - 2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of Hardware Schedule must precede fabrication of other Work (i.e., hollow metal frames) that is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by builders hardware, and other information essential to the coordinated review of Hardware Schedule.
 - 3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- E. The finish hardware Supplier/installer shall provide drawings that show details of all work to insure proper installation of the work and shall include as a minimum:
 - 1. Floor Plans: Showing all devices, pull boxes cabinets, conduits and conductors in their proposed locations.
 - 2. Riser Diagram: Showing all conduit relationships between devices shown on floor plans. Show all power sources.
 - 3. Elevations: Showing more details of the hardware and conduit relationship.

4. Details: For each equipment component such as computer, or power supply, show the rear elevation of the device and all connectors/terminations as a pictorial.
 5. Show a schedule of the wire colors connected to the pins on each device connector and wiring designations on all connectors.
- F. Samples: When requested by the Architect, submit one (1) sample of each type of exposed hardware unit requested, finished as required, and tagged with full description for coordination with schedule. Samples will be returned to the Supplier/Installer. Units that are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the Work.
- G. Templates: Supply templates to door and frame manufacturers, as required, to enable proper and accurate sizing and locations of cut-outs for hardware and door reinforcement. Delivery of templates shall be timely to prevent delays in construction.
1. Shipment of hardware prepaid to manufacturers requesting that hardware be incorporated in their Work.
 2. Where cylindrical or mortise type locks are used, furnish lock information to the door manufacturer for reinforcing in the door at the time of manufacture.

1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements. Manufacturer shall have five (5) years experience in manufacture of comparable hardware.
 2. The hardware consultant shall be, on a full-time basis, a licensed member of the Door and Hardware Institute (DHI) and a Certified Architectural Hardware Consultant (AHC) to properly detail work, order and supervise installation.
 3. The Supplier/Installer shall be a recognized architectural finish hardware Supplier/Installer who has been furnishing hardware within a 300 mile radius of the project for a period of not less than five (5) years, and who is, or employs an experienced hardware consultant who shall be available to the Owner, Architect and Contractor at reasonable times during the course of the Work for consultation about the project's hardware requirements. The Supplier/Installer shall also be a factory authorized distributor for the items specified and a holder of current and proper contractor's license.
 4. Pre-approved Subcontractor's (Supplier/Installer).
- B. Regulatory Requirements:
1. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and national or local building code requirements. Provide only hardware that has been tested and listed by an approved testing agency for types and sizes of doors required and complies with requirements of door and door frame labels.
 2. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".
 3. Comply with other applicable fire, handicapped and building codes, guidelines and regulations. Hardware supplied and installed shall meet the requirements of Arizona Revised Statutes, Title 34 Handicapped Requirements, Uniform Building code, International Building code 5, and others as applicable.

- C. Certifications: At the completion of installation, certify that material is properly installed, according to manufacturer's printed instructions. Submit certification in duplicate to the Architect after installation of hardware in accordance with Section 01 7700, Closeout Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packaging of hardware is the responsibility of the Supplier/Installer. As material is received by the hardware Supplier/Installer from the various manufacturers, sort hardware as necessary. Deliver hardware in original and individual containers, complete with necessary fastenings, keys, instructions and templates for spotting mortising tools. Items particular to a specific door shall be clearly marked by door number and heading number on the package.
- B. The hardware Supplier/Installer shall inventory hardware and verify that the count is correct. Each carton of hardware shall be marked with item numbers, corresponding to the item numbers on the Finish Hardware Schedule.
- C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control and handling and installation of hardware items that are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation. Store materials off the ground in dry, protected areas.
- D. The Supplier/Installer shall tag and index keys, manuals, schematics, operating instructions and factory diagrams for release and use by the Owner.

1.6 MAINTENANCE

- A. Provide Owner with manufacturer's parts list and maintenance instructions for each type of hardware supplied, including necessary wrenches and tools required for proper maintenance and adjustment of hardware, as supplied with hardware when shipped to General Contractor. The Supplier/Installer shall gather parts lists, tools, etc. supplied with the hardware at the time of installation and hold these items until close-out at which time they shall turn over to the General Contractor.
- B. Establish training schedule with Owner prior to turning over the keys and maintenance information to the Owner for their use.
- C. Six (6) months after Substantial Completion verify that all hardware is functional as intended. Adjust all hardware as required to restore proper function. Replace hardware items that have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware. The Supplier/Installer shall not be responsible for adjustments, corrections or replacements due to abuse, vandalism or lack of required maintenance by the Owner on the hardware.

1.7 Warranty

Special Warranty: Manufactures standard form in which manufacturer agrees to repair or replace Components of door hardware that fail under normal use in materials or workmanship not caused by improper installation.

1. Provide Thirty year warranty for door closers
2. Provide Ten year warranty for door locks
3. Provide Three year warranty on exit devices

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Owners Standards:

Butt Hinges: Ives, Bommer
Exit Devices: Von Duprin **No substitution**
Locksets: Schlage **No substitution**
Key system: Best **No substitution**
Closers: LCN **No substitution**
Threshold, Zero, NGP, Pemko
Stops, Kickplates, Pull, Push Plates: Ives, Trimco, Rockwood
Door Control Devices: Glynn-Johnson, Rixson
Smoke seal Zero, NGP, Pemko
Automatic flush Bolts: Ives, DCI
Astragals: Zero, NGP, Pemko
Automatic Operators: LCN
Magnetic Door Holders: LCN, Rixson
Removable Mullions: Von Duprin **No substitution**
Weather strip: Zero, NGP, Pemko

2.2 HARDWARE

A. Scheduled Hardware: Requirements for design, grade, function, finish, size and other distinctive qualities of each type of builders hardware is indicated in the Hardware types and the Hardware Schedule at the end of this Section. The Drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers that comply with requirements including those specified elsewhere in this Section.

B. Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

1. Furnish necessary screws, bolts or other fastenings of suitable size and type to anchor the hardware in position for heavy use and long life, and of compatible material and finish. Furnish fastenings with anchors according to the material to which it is applied, and as recommended by the manufacturer. Fasten closers on wood or mineral core doors with sex nuts and bolts.
2. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units that are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners.

C. Finish: Hardware shall be BMHA 626/652/630/689

2.3 HARDWARE TYPES

A. Butt Hinges: Shall conform to the applicable requirements of ANSI A156.1 (Federal Specifications FF-H-116e), except as otherwise specified herein. Loose pin hinges for reverse-bevel doors with locks shall be constructed in a manner that will eliminate removal of the pins when the doors are in the closed position. Determine correct clearance from the Drawings. Provide non-removable pins on exterior doors or where shown in the Hardware Schedule. Provide five knuckle, concealed ball bearing hinges on doors. Flat button, top and bottom tips required on butt hinges. Exterior out swinging doors shall be equipped with thrust pivots TPU-1.

1. Butt Hinge Length:

<u>Thickness of door</u>	<u>Width of door</u>	<u>Height of Butt Hinges</u>
1-3/4 in. door	to 36 in.	4-1/2 in.
1-3/4 in. door	over 36 in. to 48 in.	5 in.
1-3/4 in. door	over 48 in.	6 in.
2. Number of Butt Hinges required:
 - a. Doors 60 inches high and under: 2 butt hinges
 - b. Doors over 60 inches high and not over 90 inches high: 3 butt hinges
 - c. Doors over 90 inches high and not over 120 inches high: 4 butt hinges
3. Hinge Types: Shall conform to the applicable requirements of Specification FF-H-121c, except as specified otherwise herein.
 - a. Interior doors without closers: Ives 5BB1HW
 - b. Interior doors with closers: Ives 5BB1HW

B. Door Locks:

1. Conform to the applicable requirements for ANSI A156.13 Series 1000, Grade 1. The series selected shall, as far as practicable, be used throughout the project. Lock and latch sets of a series shall be the products of a single manufacturer. Lock and latch design, style and application shall meet handicapped access standards and codes where applicable.
2. Locksets to be heavy duty Schlage ND Series RHO 06N or Tubular 03N Functions as listed in hardware sets **No substitution.**
3. Provide locks and latchsets with 2-3/4 inch brackets, unless otherwise noted. Provide strikes with extended lip where required to protect trim from being marked by latch bolt. Provide, at wood frames and/or wood doors (when in pairs) wrought boxes.

C. Door Closers:

1. Door closers shall meet handicapped access standards and codes. Complying with ANSI A117.1 for door opening force and delayed action closing.
2. Surface mounted LCN 4040XP Series with 689 Finish, spray to match other hardware. Bodies; to be close grained malleable iron, with three (3) separate control valves (including back check). ANSI Grade I. Closers to be equipped with size adjustment (1 thru 6). Equip closers mounted on wood or mineral core doors with TBWMS.

D. Exit Devices:

1. Shall be U.L. approved for casualty. Fire doors to be equipped with rated exit devices meeting fire label requirements. Von Duprin 99 Series, Functions as listed in hardware sets. Lever trim with exit devices shall be heavy duty lever trim Type 996L.

- E. Kickplates: Shall be .050 thick (minimum), 12 inches high, by 2 inches less than door width for single doors and one inch less than the width for double doors without removable mullion. Finish 630
- F. Overhead Holders or Stops: As listed in hardware sets. Finish 630
- G. Stops and Bumpers: Wall type WS401/402 CVX shall be used when possible.
- H. Silencers: Supply three (3) each at jambs of single doors and two (2) each at pairs of doors. Not required on doors having seals.
- I. Flush Bolts: As manufactured by Door Controls.
 - 1. Manual Flushbolts Type FB458
 - 2. Automatic Flushbolts Type FB51P
 - 3. Furnish flush bolts with DP2 dust proof strikes.
- J. Weatherstrip and Smoke Seals:
 - 1. Weatherstrip shall be as listed in the Hardware Sets.
 - 2. Smoke Seals shall be as listed in the Hardware Sets.
 - 3. Door Bottoms shall be as listed in Hardware Sets.
 - 4. Astragals shall be as listed in the Hardware Sets.
 - 5. Door top weatherstopping shall be as listed in the Hardware Sets.
- K. Thresholds: as listed in the Hardware Sets.
- L. Push Plates: Shall be .050 thick (minimum), 4 x 16 edges beveled.
- M. Drip strip: Extruded aluminum, finish to match balance of hardware. Install drip caps at all exterior doors not protected by an overhang.

2.4 HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Provide finishes which match those established by BHMA or, if none established, match the existing facility.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
- D. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials & Finishes Standard 1301" by BHMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

2.5 LOCK CYLINDERS AND KEYING

- A. General: Supplier shall meet with Owner to finalize keying requirements and obtain final instructions in writing.

- B. Keying: Except as otherwise indicated, provide grand master key system keyed into existing system as directed by Owner.
- C. Furnish appropriate cylinders for padlocks for overhead doors, wire mesh partitions, gates, roof hatches, etc. and master key into system.
- D. Provide construction cores at exterior doors and at interior secured storage doors as designated by the Contractor. All locksets and cylinders shall be "interchangeable" (High Security, Patented, Restricted Cylinder and Keys). Permanent keys shall not be under any circumstance made available to the General Contractor. Furnish ten (10) construction keys to the Contractor.
- E. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
- F. Key Quantity: Furnish three (3) change keys for each lock; six (6) master keys for each master system; and five (5) grandmaster keys for each grandmaster system.
 - 1. Furnish one (1) extra blank for each lock.
 - 2. Deliver keys to Owner's representative.
 - 3. Keys shall be made by the manufacturer of the locks. No "off brand" key blanks are acceptable.
 - 4. Keys shall be stamped "Do Not Duplicate".
- G. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, as recommended by system manufacturer, with capacity of 150 percent of the number of locks required for the project.
 - 1. Set up complete cross index system and place keys on markers and hooks in the cabinet as determined by the final key schedule.
 - 2. Provide cabinet with two tag deluxe system, minimum 50 percent greater capacity than required herein.

2.6 KNOX BOX

- A. Knox Box: Model 3200-R, 4"W x 5"H x 3-1/4" deep with 7"W x 7"H flange, black polyester powder coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. As part of the hardware installation, the Supplier/Installer shall examine the hollow metal door frames and other surfaces to receive hardware for accuracy of installation and alignment. The Supplier/Installer shall report in writing to the Contractor with a copy to the Architect, of detrimental conditions. Failure to perform this requirement constitutes a waiver to subsequent claims to the contrary and holds the Supplier/Installer responsible for corrections the Architect may require. Commencement of Work shall be construed as acknowledgment by the Supplier/Installer that doors and frames and other surfaces to receive hardware are in compliance with the requirements of the Contract Documents.

3.2 PREPARATION

- A. The Supplier/Installer shall meet with the Owner, Architect, and related trades prior to the commencement of Work. Tag items or packages with identification related to the final hardware schedule, and include basic installation instructions in the package.
- B. Deliver hardware items at the proper times to the proper locations (ship to project site) for installation.

3.3 INSTALLATION

- A. Install each hardware item in compliance with the manufacturer's instructions and recommendations.
- B. Mount hardware units at heights as recommended per SDI-100, except as specifically indicated or required to comply with governing regulations, and except as may be directed otherwise by Architect.
- C. Install exterior thresholds in full bed of sealant to prevent intrusion of water. Install into concrete using 1/4 inch x 7/8 inch machine screw anchors.
- D. Application of Hardware: Hardware shall be installed in a neat, workmanlike manner following the manufacturer's instructions. Fasteners, supplied with the hardware, shall be used to secure the hardware in place. Wood screws shall be used for securing hardware to wood surfaces. Machine screws, set in expansion shields, shall be used for securing hardware to concrete or masonry surfaces. Thru-bolts shall be used where specified or where necessary for satisfactory installation.
- E. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on the substrate. The Supplier/Installer shall be responsible for correct application according to factory installation instructions.
- F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry.
- G. Install thresholds in full bed of sealant from jamb to jamb.
- H. Coordinate wiring, conduit, junction boxes, power supply, etc. and install equipment required for operation of electronic hardware.
- I. Knox Box: Recessed into wall construction and rigidly anchored in place at locations indicated on Drawings in accordance with requirements for Fire Department access.

3.4 FIELD QUALITY CONTROL

- A. Inspection: The Supplier/Installer shall provide a final inspection with the Owner, and Architect at the completion of the installation.
- B. After hardware is checked, keys shall be tagged, identified and delivered to the Owner by registered mail, or delivered in person after receiving a signed receipt from a responsible representative of the Owner.
- C. Errors in cutting or fitting, or damage to adjoining work shall be repaired, as directed.

3.5 ADJUSTING

- A. Check and adjust each operating item of hardware and each door, to ensure proper operation or function for each unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.6 CLEANING

- A. Insure that after installation, the materials furnished and installed will be free of paint or lacquer as may appear from the Work of other subcontractors. Clean operating items as necessary to restore proper function and finish of hardware and doors.
- B. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition in accordance with Section 01 5000, Temporary Facilities and Controls.

3.7 PROTECTION

- A. After application, hardware shall be protected from paint, stains, blemishes and damage until acceptance of the Work.

3.8 HARDWARE SCHEDULE

- A. While the following hardware sets are intended to cover doors and establish a type and standard of quality, it shall be the specific duty and responsibility of the hardware supplier to examine the drawings and specifications and furnish proper hardware for openings. The hardware supplier shall compare the specifications with the door schedule and notify the Architect of errors, inconsistencies or omissions during the bid period.

HARDWARE GROUP NO. 01

For use on Door #(s):

103	104	114	124	125	126
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Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG TBWMS	689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HARDWARE GROUP NO. 02

For use on Door #(s):

105 113 128 139

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 03

For use on Door #(s):

107

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10	↗	689	VON
1	EA	STOREROOM LOCK	ND80BDEU RHO 12V/24V DC	↗	626	SCH
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	KEYPAD	BY SECURITY CONTRACTOR	↗ CR	BLK	SCE
1	EA	DOOR CONTACT	679-05	↗	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	↗		VON

DOOR NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT KEYPAD READER OR BY KEY AT RIM CYLINDER.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 04

For use on Door #(s):

137

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10	↗	689	VON
1	EA	STOREROOM LOCK	ND80BDEU RHO 12V/24V DC	↗	626	SCH
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	MULTITECH READER	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	↗	BLK	SCE
1	EA	DOOR CONTACT	679-05	↗	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	↗		VON

DOORS NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 05

For use on Door #(s):

108A

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10	↗	689	VON
1	EA	ELEC PANIC	RX-QEL-99-L-NL-06-CON 24 VDC	↗	626	VON
		HARDWARE				
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	MULTITECH READER	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	↗	BLK	SCE
1	EA	DOOR CONTACT	679-05	↗	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	↗		VON

DOORS NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY AT RIM CYLINDER.

RX SWITCH IN QEL PANIC DEVICE SHUNTS DOOR FORCED OPEN ALARM IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06

For use on Door #(s):

111

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 07

For use on Door #(s):

110

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	99-L-NL-06		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP CUSH TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 08

For use on Door #(s):

112

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53BD RHO	626	SCH
1	EA	PERMANENT CORE	1C72	626	BES
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 09

For use on Door #(s):

115A 115B 127 130A 136

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	99-L-BE-06	626	VON
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HARDWARE GROUP NO. 10

For use on Door #(s):

116 117 118 119 120 121
122 123

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	111AA	AA	ZER

HARDWARE GROUP NO. 11

For use on Door #(s):

108B 138

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	99-L-BE-06	626	VON
1	EA	SURFACE CLOSER	4040XP REG TBWMS	689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8655A	A	ZER

HARDWARE GROUP NO. 12

For use on Door #(s):

141A 141B 146

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG TBWMS	689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	111AA	AA	ZER
1	EA	THRESHOLD	8655A	A	ZER

HARDWARE GROUP NO. 13

For use on Door #(s):

144

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD RHO	626	SCH
1	EA	PERMANENT CORE	1C72	626	BES
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8655A	A	ZER

HARDWARE GROUP NO. 14

For use on Door #(s):

140D

Provide each SGL door(s) with the following:

1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	⚡	689	VON
1	EA	ELEC PANIC	RX-QEL-99-L-NL-06-CON 24 VDC	⚡	626	VON
		HARDWARE				
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS444		626	IVE
1	EA	GASKETING	8303AA		AA	ZER
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	MULTITECH READER	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	⚡	BLK	SCE
1	EA	DOOR CONTACT	679-05	⚡	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY SECURITY CONTRACTOR	⚡		VON

DOORS NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY AT RIM CYLINDER.

RX SWITCH IN QEL PANIC DEVICE SHUNTS DOOR FORCED OPEN ALARM IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 15

For use on Door #(s):

129B

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53BD RHO		626	SCH
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	SURFACE CLOSER	4040XP REG TBWMS		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. AL01

For use on Door #(s):

101 106A 129A 134

Provide each SGL door(s) with the following:

1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	↗	689	VON
1	EA	ELEC PANIC	RX-QEL-99-NL-OP-110MD-CON-	↗	626	VON
		HARDWARE	24VDC			
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	90 DEG OFFSET	8190HD 10" STD		630	IVE
		PULL				
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	CUSH SHOE	4040XP-30		689	LCN
		SUPPORT				
1	EA	PA MOUNTING	4040XP-18PA		689	LCN
		PLATE				
1	EA	BLADE STOP	4040XP-61		689	LCN
		SPACER				
1	EA	FLOOR STOP	FS444		626	IVE
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	MULTITECH READER	BY SECURITY CONTRACTOR BY	↗	BLK	SCE
			SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	679-05	↗	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY	↗		VON
			SECURITY CONTRACTOR			
1	EA	WIRING DIAGRAM	POINT TO POINT		WIR	
1			SEALS BY DOOR/FRAME			
			MANUFACTURER			

DOORS NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY AT RIM CYLINDER.

RX SWITCH IN QEL PANIC DEVICE SHUNTS DOOR FORCED OPEN ALARM IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. AL02

For use on Door #(s):

106B

Provide each SGL door(s) with the following:

1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	⚡	689	VON
1	EA	ELEC PANIC	RX-QEL-33A-NL-OP-388-CON 24	⚡	626	VON
		HARDWARE	VDC			
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	PERMANENT CORE	1C72		626	BES
1	EA	90 DEG OFFSET	8190HD 10" STD		630	IVE
		PULL				
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	BLADE STOP	4040XP-61		689	LCN
		SPACER				
1	EA	PA MOUNTING	4040XP-18PA		689	LCN
		PLATE				
1	EA	CUSH SHOE	4040XP-30		689	LCN
		SUPPORT				
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	WIRE HARNESS	CON-AS REQUIRED			SCH
1	EA	MULTITECH READER	BY SECURITY CONTRACTOR BY	⚡	BLK	SCE
			SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	679-05	⚡	WHT	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR BY	⚡		VON
			SECURITY CONTRACTOR			
1	EA	WIRING DIAGRAM	POINT TO POINT		WIR	
1			SEALS BY DOOR/FRAME			
			MANUFACTURER			

DOORS NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY AT RIM CYLINDER.

RX SWITCH IN QEL PANIC DEVICE SHUNTS DOOR FORCED OPEN ALARM IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. AL03

For use on Door #(s):

130B

Provide each PR door(s) with the following:

2	EA	CONT. HINGE	112HD	628	IVE
1	EA	FIRE RATED	KR9954 STAB	689	VON
		REMOVABLE			
		MULLION			
1	EA	PANIC HARDWARE	99-NL-OP-110MD	626	VON
1	EA	PANIC HARDWARE	99-EO	626	VON
1	EA	RIM CYLINDER	1E72	626	BES
2	EA	PERMANENT CORE	1C72	626	BES
1	EA	MORTISE CYLINDER	1E74	626	BES
2	EA	90 DEG OFFSET PULL	8190HD 10" STD	630	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
2	EA	CUSH SHOE	4040XP-30	689	LCN
		SUPPORT			
2	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	BLADE STOP	4040XP-61	689	LCN
		SPACER			
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1		SEALS BY DOOR/FRAME			
		MANUFACTURER			

HARDWARE GROUP NO. FLD01

For use on Door #(s):

140A 140B 140C

Provide each FLD door(s) with the following:

1		HARDWARE BY DOOR / FRAME
		MANUFACTURER

HARDWARE GROUP NO. OH01

For use on Door #(s):

140E 140F 140G

Provide each RU door(s) with the following:

1		HARDWARE BY DOOR / FRAME
		MANUFACTURER

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Glass and glazing for interior and exterior applications.
- B. Related Sections:
 - 1. Section 08 83 00 – Mirrors, for wall mounted frameless mirrors.

1.02 PERFORMANCE REQUIREMENTS

- A. Glass and glazing materials shall provide continuity of building enclosure vapor and air barrier.
 - 1. To utilize the inner pane of multiple pane sealed units for the continuity of air and vapor seal.
 - 2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- B. Glass thickness indicated is minimum and shown for detailing only. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with IBC Chapter 24, as measured in accordance with ANSI/ASTM E330.
- C. Limit glass deflection to 1/175 or flexure limit of glass, with full recovery of glazing materials, whichever is less.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's Product Data for glass units, including the following:
 - 1. Structural, physical and environmental characteristics.
 - 2. Size limitations.
 - 3. Special handling or installation requirements
 - 4. Special application requirements for glazing materials.
 - 5. Available colors of glass and glazing materials with color selections.
- B. Samples: Submit samples as follows:
 - 1. Two samples 8 x 8 inch in size of each type of glass product required, illustrating coloration, edge treatment and design.
 - 2. Four-inch-long bead of glazing sealant, color as selected.
- C. Manufacturer's Certificate: Submit Manufacturer's certification that sealed insulated glass meets or exceeds specified requirements.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to 2012 IBC Chapter 24, to local requirements and to State law.

- B. Standards:
 - 1. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 2. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 - 3. GANA'S - Glazing Manual and Laminated Glass Design Guide.
- C. Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, and Laminators Safety Glass Association - Standards Manual for Glazing Installation Methods.
- D. Source Limitations: Obtain each type of glass from a single manufacturer using the same type of glass lights and inner layers for each type of glass type or unit specified. Obtain glazing assemblies from one source for each product and/or installation specified and/or required.
- E. Installer Qualifications: An experienced installer who has successfully completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance for a minimum of 10 years; and who employs glass installers for this project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.06 WARRANTY

- A. Provide 5 year Manufacturer's warranty for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Materials: Furnish products of one of the following Manufacturers, except as otherwise approved by the Architect, subject to compliance with Specification requirements:
 - 1. Guardian Industries. www.guardian.com .
 - 2. Oldcastle Glass Group. www.oldcastleglass.com .
 - 3. Pilkington LOF. www.pilkington.com .
 - 4. PPG Industries. www.ppgideascales.com .
 - 5. Viracon. www.viracon.com.

2.02 GLASS MATERIALS

- A. Float Glass: ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; 1/4 inch thick minimum.

- B. Safety Glass: ASTM C1048, Kind FT fully tempered with horizontal tempering Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1; 1/4 inch minimum.
- C. Laminated Safety Glass: ASTM C1172, Kind LT, consisting of two lites of 1/8 inch fully tempered float glass with manufacturers standard polyvinyl butryal sheet. Laminate units in autoclave with heat plus pressure to produce units of the following minimum thicknesses, but not less than required by performance requirements and complying with ANSI Z97.1.
 - 1. Thickness 5/16 inch minimum.

2.03 SEALED INSULATING GLASS MATERIALS

- A. Insulating Glass: Units shall comply with ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 1. Units shall be certified for compliance by the IGCC in accordance with the above ASTM test method.
 - 2. The unit overall thickness tolerance shall be minus 1/16 inch / plus 1/32 inch. Unit constructed with patterned or laminated glass shall be plus or minus 1/16 inch.
 - 3. Shall comply with ASTM E546 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 - 4. Shall comply with ASTM E576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position
 - 5. Sealed Insulating Glass Units to be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone.
 - a. The minimum thickness of the secondary seal shall be 1/16 inch.
 - b. The target width of the primary seal shall be 5/32 inch.
 - c. There shall be no voids or skips in the primary seal.
 - d. Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1/16 inch by maximum length of 2 inches with gaps separated by at least 18 inches. Continuous contact between the primary seal and the secondary seal is desired.
 - e. Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
 - 6. To provide a hermetically sealed and dehydrated space, lites shall be separated by an aluminum spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint.
 - a. Finish: Color to match aluminum frames.
 - 7. Individual panes of insulated glass units shall be Kind HS (heat strengthened) or Kind FT (fully tempered) where required to resist thermal stress in insulating glass units as determined by the manufacturer, or Kind FT (fully tempered) where indicated or required by Code by location.
- B. Tinted, Low-E Insulated Glass Units: PPG Solarban 60 (2) low-E on Solarbronze insulating glass units complying with ASTM E774 and E773 and as follows or as otherwise approved by the Architect from one of the specified acceptable manufacturers:
 - 1. Pane: Double pane
 - 2. Edge Seal: Silicone sealant
 - 3. Outer Pane: 1/4 inch thick, PPG Solarbronze with Solarban 60 on No. 2 surface.
 - 4. Inner Pane: 1/4 inch thick, clear glass.
 - 5. Visible Light Transmittance: 42 percent.
 - 6. Solar Energy Transmittance: 21 percent.
 - 7. Visible Light Reflectance: 7 percent.

8. Total Solar Energy Reflectance: 15 percent.
9. U-Value:
 - a. Winter Night Time: 0.29.
 - b. Summer Day Time: 0.27.
10. Shading Coefficient: 0.32.
11. Solar Heat Gain Coefficient: 0.28.
12. Light to Solar Gain (LSG): 1.50
13. Interpane Space: Purged dry air.
14. Total Unit Thickness: 1 Inch.

2.04 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness tested for compatibility with glazing sealant, minimum length 4 inches, sized per GANA guidelines.
- B. Spacers: Neoprene or EPDM blocks of 65+5 Shore A durometer hardness, designed to maintain positioning of glass and prevent shifting of glass in the glazing pocket and tested for compatibility with specified glazing sealant.
- C. Glazing Gaskets: Neoprene or EPDM and silicone compatible, non-cellular dense, 75 +/- 5 Shore A durometer, complying with ASTM C864, option 1 or 2.
 1. Bed all gasket corners, molded or not in elastomeric silicone sealant.
- D. Interior Glazing Compound: Polymerized Butyl Rubber and Inert Fillers (pigments), solvent based with minimum 75% solids, non-sag consistency, tack-free time of 24 hours or less, paintable non-staining.
- E. Exterior Glazing Compound: Conforming to ASTM C920, Type S, Grade NS, Use G. Compound shall be paintable, or colored to match frame.
- F. Glazing Tape: Preshimmed 10 percent solids, non-shrinking, butyl rubber tape compatible with sealants. If exposed, tape shall be paintable, or colored to match frame.

2.05 MARKINGS

- A. Tempered glass shall have each light permanently etched with Manufacturer's name and his compliance with ANSI Z-97.1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Examine framing or glazing channel surfaces, backing, removable stop design, and conditions under which glazing is to be performed.
- C. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Comply with combined recommendations of Glass Manufacturer, aluminum frame manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified.
- B. Clean the glazing, channel, or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate.
- C. Do not attempt to cut, seam, nip, or abrade glass which is tempered or heat strengthened.
- D. Comply with "Glazing Manual" by GANA, except as shown and specified otherwise by Manufacturers of glass and glazing materials.
- E. Inspect each piece of glass immediately before installation, and discard those which have observable edge damage or face imperfections.
- F. Install setting blocks of proper size at quarter points or eighth points but at no time closer than 6 inches from the end of the horizontal frame in a bead of clear silicone sealant.
- G. Provide spacers inside and out, and of proper size and spacing, for glass sizes larger than 50 united inches. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width.
- H. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
- I. Gasket Glazing:
 - 1. Fabricate gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
 - 2. Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.
 - 3. Insert gasket between glass and frame or fixed stop, securely in place.

3.03 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Clean contact surfaces with solvent.
- B. Cut glazing tape to proper length and set against permanent stops, 3/16 inch below sightline. Weld corners together by butting tape and dabbing with sealant.
- C. Apply bed of sealant along exterior void ensuring full contact with glass.
- D. Place setting blocks at 1/4 points or eighth points, but at a minimum 6 inches from the near edge of block to edge of glass.
- E. Rest glass on setting blocks and push against tape (and heel bead of sealant) with sufficient pressure to ensure full contact and adhesion at perimeter.
- F. Install removable stops, spacer strips inserted between glass, and applied stops at 2-foot intervals, 1/4 inch below sightline. Place glazing tape on glass with tape flush with sightline.

- G. Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass but not more than 3/8 inch below sightline.
- H. Apply cap bead of sealant along exterior void, to uniform and level line, flush with sightline. Tool or wipe cap bead surface with solvent for smooth appearance.

3.04 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to proper length and install against permanent stop, projecting 1/16 inch above sightline.
- B. Place setting blocks at 1/4 point or eighth points, but at a minimum of 6 inches from the near edge of block to edge of glass.
- C. Rest glass on setting blocks and push against tape with sufficient pressure to ensure full contact and adhesion at perimeter.
- D. Install removable stops; spacer strips inserted between glass and applied stops at 2 foot intervals, 1/4 inch below sightline.
- E. Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass to uniform and level line.
- F. Neatly trim off excess tape to sightline.

3.05 ADJUSTING

- A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in any other way during the construction period, including natural causes, accidents and vandalism.

3.06 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.
- B. Remove labels after Work is completed.

3.07 PROTECTION

- A. Protect glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass.
- B. Do not apply markers of any type to surfaces of glass.

END OF SECTION

SECTION 08 83 00

MIRRORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Frameless, bottom track and mastic support, custom size mirrors as shown on Drawings and as specified.

1.02 SUBMITTALS

- A. Product Data: Submit physical and environmental characteristics, size limitations, and special handling or installation requirements for glass mirror materials.
- B. Samples: Submit samples of mirror support hardware.

1.03 QUALITY ASSURANCE

- A. Standards: ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- B. Perform Work in accordance with FGMA Glazing Manual.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Mirror Glass: ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q1 mirror select; 1/4 inch thick, with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface. Provide fully tempered units where indicated or required by Code by location
 1. Size(s): As indicated on Drawings.
 2. Edge Treatment: Square ground edges, painted flat black, unless otherwise indicated on Drawings.
 3. Factory seal edges of silvered mirrored glass immediately after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 4. Laminated Safety Glass Mirrors: Provide laminated mirrored glass fabricated to produce units complying with ASTM C1172, Kind LM, where indicated or required by Code.

2.02 ACCESSORIES

- A. Setting Blocks and Gaskets: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness tested for compatibility with glazing sealant, minimum length 4 inches.
- B. Mirror Mastic: Polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion, compatible with mirror backing paint and approved by mirror manufacturer.
- C. Mirror Setting Hardware:
 - 1. Bottom Support Channel: Provide extruded aluminum J-channel, length to match width of mirror; channel size to accept thickness of mirror with maximum 3/8-inch channel depth (front channel leg).
 - 2. Finish: As indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION - GENERAL

- A. Comply with combined recommendations of Mirror Manufacturer and manufacturer of mirror mastic and other materials used in setting mirrors, except where more stringent requirements are shown or specified.
- B. Clean the wall surface, or other substrate to receive mirrors, immediately before installation. Remove coatings which are not firmly bonded to the substrate.
- C. Do not attempt to cut, seam, nip or abrade glass which is tempered or heat strengthened.
- D. Comply with "Glazing Manual" by FGMA, except as shown and specified otherwise by Manufacturers of mirrors and mirror mastic materials.
- E. Inspect each piece of mirror immediately before installation, and discard those which have observable edge damage or face imperfections.

3.03 ADHESIVE INSTALLATION OF MIRRORS

- A. Install mirrors by mirror mastic spot method as follows, unless otherwise indicated on Drawings:
 - 1. Attach mirror bottom support channel securely to wall, level and flush with wall surface, with mechanical fasteners, including anchors and inserts as required for supporting wall construction.
 - 2. Apply mirror mastic in spots at equal spacing to cover not more than 25 percent of back of mirror and as required to maintain air circulation behind back of mirror.

3. Set mirror in support channel on setting blocks or continuous gasket and press against substrate to ensure bond of adhesive.
4. Leave open ventilation space, 1/8 inch or more in thickness between mirror and substrate, over 75 percent of mirror area (wherever there is no adhesive).

3.04 ADJUSTING

- A. Remove and replace mirrors which are broken, chipped, cracked, abraded or damaged in any other way during the construction period, including natural causes, accidents and vandalism.

3.05 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.
- B. Remove labels after Work is completed.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Formed metal stud framing, furring, suspension systems and accessories as shown on Drawings and as specified.

1.02 SUBMITTALS

- A. Product Data: Submit data describing standard framing member materials and finish, product criteria, load charts, limitations, and installation instructions.
- B. Certificates: Mill Certification shall be provided with shipment to verify chemical composition, yield strength, tensile strength, elongation and coating thickness. Include listing of applicable ASTM standards specified in this section and comparison of ASTM requirements to actual materials provided to jobsite.
- C. Manufacturer's letter: Manufacturer shall provide letter stating that the material supplied to the specific project meets or exceed the performance standards listed in these specifications.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. ASTM C 754 requirements.
 - 2. Applicable Code and Regulatory Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products as manufactured by a manufacturing member of the Steel Stud Manufacturers Association (SSMA) or the Steel Framing Industry Association (SFIA), subject to compliance with Specification requirements.

2.02 FRAMING MATERIALS

- A. Studs, Runners and Furring Channels:
 - 1. Steel complying with ASTM C645-07 requirements for metal; C-channel, roll-formed from hot dipped galvanized steel; complying with ASTM A1003 and ASTM A653 G40 or equivalent corrosion resistant coating.
 - 2. Material Thickness: Gauge or Mil thickness indicated on Drawings, but not less than minimum thickness in accordance with the latest edition of the SSMA Product Technical Information manual, Limiting Wall Height Tables, as required by height of wall, or equivalent from the SFIA.
 - 3. Provide 16 gauge structural metal studs specified in Section 05 41 00 at walls where noted with wall hung attachments.

3. Deflection Track: Provide deep leg, 2 inch minimum, head track, or one of the following proprietary systems:
 - a. Slotted Top Track (non-fire rated and fire-rated, as applicable): SLP-TRK® as manufactured by Sliptrack Systems (888) 475-7875 www.BradyInnovations.com, as distributed by Dietrich Metal Framing (614) 438-3210 www.dietrichindustries.com, gauge as per ICBO ER-5344, Table 2. Provide fire rated assemblies in accordance with manufacturer's literature, where applicable.
 - b. Non-Fire Rated Slotted Top Track - Single Track Slip System for Interior Partitions: As manufactured by Metal Lite, Inc., Anaheim, CA (800) 886-6824. Provide for partitions that are not required to be fire rated.
 - c. Fire Rated Shadowline Top Track - Single Track Slip System for Interior Partitions: Applicable configuration as required for fire rating as manufactured by Fire Trak Corporation, Kimball, MN (800) 394-9875. Provide for partitions that are required to be fire rated.

- B. Studs and Track: C-shaped, non-structural rolled steel, punched for utility access.
 1. Stud Sizes: Provide studs of member depth and spacing indicated on Drawings with flange width and material thickness in accordance with the latest edition of the SSMA Product Technical Information manual, Limiting Wall Height Tables, as required by height of wall, or equivalent from the Steel Framing Industry Association (SFIA).

- C. Ceiling Runners: Cold or hot-rolled steel, meet ASTM C754.

- D. Hanger and Tie Wire: Meet ASTM C754.

- E. Compression Struts: C-shaped steel studs in minimum thickness as required to adequately resist the vertical component induced by the bracing wires in suspended ceiling applications.

- F. Furring Members: Of same gauge, material and finish as studs, thickness to suit purpose.

- G. Grid Type Ceiling Suspension System: Heavy duty, direct-hung, tee-grid gypsum board ceiling support system composed of galvanized finish commercial quality cold-rolled steel double web main and cross tees, clips, and preformed curved components.
 1. Hanger Wire: Galvanized steel conforming to Federal Specification FF-QQ-W-461, Finish 5, Class 1 annealed, and not less than 12 gage).
 2. Suspension system shall support the ceiling system specified with a maximum deflection of 1/360 of the span.
 3. Acceptable Manufacturers:
 - a. Armstrong
 - b. USG Interiors, Inc.

- H. Channel Bridging and Bracing: Channel bridging and bracing members of same material and finish as studs. Spazzer® 9200 Bridging and Bracing Bar and Spazzer® Bar Guard, or U-channel assembly, thickness to suit purpose with EasyClip™ U-Series Clip Angle or equivalent.

- I. Clips, Brackets: Galvanized wire or sheet metal designed for attachment of framing, furring and bridging members.
 - 1. Deflection Clips: If acceptable to Building Official, VertiClip™ as manufactured by Signature Industries, LLC, Raleigh, NC (919) 844-0789, or FastClip™ or QuickClip™ as manufactured by Dietrich Metal Framing, Columbus, OH (614) 438-3210 may be provided for attachment of framing to roof and floor construction at head and slide conditions. Provide sizes as required for stud depth(s). Clips shall be manufactured of steel conforming to ASTM A 653 Prime Certified G90 galvanized material, 50 ksi yield strength and 65 ksi ultimate strength. Deflection clips to have positive attachment to structure and stud material while allowing for frictionless movement.
 - 2. Bridging Clips: If acceptable to Building Official, BridgeClip™ as manufactured by Signature Industries, LLC, Raleigh, NC (919) 844-0789, or EasyClip™ U or X series as manufactured by Dietrich Metal Framing, Columbus, OH (614) 438-3210, may be provided for attachment of bridging to studs.
- J. Fasteners: ASTM C1513, self-drilling, self-tapping screws.
- K. Anchorage Devices: Power driven, powder actuated, drilled expansion bolts or screws with sleeves as required for positive anchorage.
- L. Acoustic Sealant: As specified in Section 07 92 00.
- M. Primer: FS TT-P-645, for touch-up of galvanized surfaces.
- N. Backing: Provide backing plate, stud or proprietary backing members of type and configuration indicated on Drawings, and as follows:
 - 1. 16 gauge minimum galvanized steel sheet.
 - 2. 16 gauge minimum c-shaped steel stud.
 - 3. "Notch-Tite" and "Flush Mount" as manufactured by Metal Lite, Inc., 3070 E. Miraloma Avenue, Anaheim, CA 92806 (800) 886-6824.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are ready to receive Work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that rough-in utilities are in proper location.
- D. Beginning of installation means acceptance of substrate.

3.02 METAL STUD ERECTION

- A. Install stud framing in accordance with ASTM C 754.
- B. Align and secure top and bottom runners at 24 inches o.c. and within 6 inches from each end. Place two beads of acoustic sealant between runners and substrate.
- C. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.

- D. Install studs vertically at center to center stud spacing indicated in stud schedule on Drawings. Place two beads of acoustic sealant between studs and adjacent vertical surfaces. Install felt strips between wall and stud where studs abut exterior walls.
- E. Connect studs to bottom track using fastener method.
- F. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- G. Backing and Blocking: Provide 16 gauge minimum backing and blocking attached to studs. Bolt or screw steel channels to studs. Install backing and blocking for support of plumbing fixtures, toilet partitions, wall cabinets, building accessories, toilet accessories, wall brackets, hardware, and other wall mounted items. If proprietary system is used, install in accordance with Manufacturer's printed instructions.
- H. Coordinate installation of bucks, anchors, blocking, electrical and mechanical Work placed in or behind partition framing.
- I. Splice studs, where necessary, with 8 inch nested lap. Secure each stud flange with flush head screw.
- J. Construct corners using minimum three studs.
- K. Brace stud framing system and make rigid.
- L. Coordinate erection of studs with requirements of door and window frame supports and attachments.
- M. Align stud web openings.
- N. Refer to Drawings for indication of partitions extending to ceiling only and for partitions extending through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide nested extended leg ceiling runners, deflection clips or proprietary slip track with studs allowed to float (no screw attachment) to allow for overhead deflection.
- O. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.

3.03 WALL FURRING INSTALLATION

- A. Erect wall furring for direct attachment to masonry walls plumb and true to line using galvanized steel or plastic shims as required to plumb wall.
- B. Erect furring channels vertically. Secure in place on alternate channel flanges at maximum 24 inches.
- C. Space furring channels maximum 16 inches on center, not more than 4 inches from floor and ceiling lines, and butting walls.
- D. Install furring channels directly attached to masonry walls, as applicable in accordance with Manufacturer's instructions.

- E. Erect free-standing metal stud framing tight to concrete, concrete and brick masonry walls, attached by adjustable furring brackets in accordance with Manufacturer's instructions.

3.04 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C 754.
- B. Coordinate location of hangers with other Work.
- C. Install suspended ceiling framing independent of walls (except where required for structural support), columns, ducts, pipes, conduit and other obstructions. Where required provide additional suspended structural members in trapeze fashion to span underside of ductwork and other obstructions, with main suspension of ceiling system suspended from the additional members. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
 - 1. Do not attach metal framing to ducts, pipes, conduit and similar items or allow items to come in contact with framing or gypsum board applied to framing.
 - 2. Provide isolation framing assemblies where required for support of framing.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches beyond each end of openings.
- E. Laterally brace entire suspension system.
- F. No hanger support shall be allowed from roof deck.
- G. At steel beams, joists or other steel construction wrap hangers around, inset through, or clip or bolt to the supports, so as to develop the full strength of the hangers.
- H. At lights or other openings that interrupt the main runner or furring channels reinforce grillage with 3/4 inch channels, wire tied atop and parallel to the main runner channels.
- I. Do not bridge control and expansion joints with metal furring. Provide separate supports on each side of joint.

3.05 GRID TYPE CEILING SUSPENSION SYSTEM INSTALLATION

- A. Grid Type Ceiling Suspension System: Install suspension system in accordance with manufacturer's instruction and the following:
 - 1. ASTM C636 and as supplemented in this Section.
 - 2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical tile and Lay-in Panel Ceilings, for seismic zone/class indicated on General Structural Notes on Drawings.
 - 3. IBC Chapter 16 requirements for suspended ceilings for Seismic Design Category indicated in General Structural Notes on Drawings.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- C. Install after major above-ceiling Work is complete. Coordinate the location of hangers with other Work.
- D. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

- E. Hang suspension system independent of walls, columns, ducts, pipes, conduit, and other obstructions. Where required, provide additional suspended structural members to form "trapeze" to span underside of ductwork or other obstruction, with main suspension of ceiling system suspended from the additional members.
 - 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

3.06 FIELD QUALITY CONTROL

- A. Testing: At Owner's request, Contractor shall provide spot testing of actual properties of steel framing to verify compliance with specifications.

3.07 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes gypsum board and installation accessories as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Section 06 10 00 – Rough Carpentry, for wood stud framing.
 - 2. Section 09 22 16 – Non-Structural Metal Framing, for metal stud framing and furring.

1.02 SYSTEM DESCRIPTION

- A. Acoustical Attenuation for Interior Partitions: Comply with STC rating indicated for Partition Types indicated on Drawings and in accordance with ANSI/ASTM E90.

1.03 SUBMITTALS

- A. Product Data: Submit data on gypsum board, joint, finish and accessories.
- B. Samples: Submit sample of textured finish prior to application.
- C. Reports: Submit fire test report for fire rated assemblies and acoustical performance test reports for acoustically-rated assemblies.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in Gypsum Board Systems Work with 2 years documented experience and approved by Manufacturer.
- B. Regulatory Requirements: Conform to applicable code for fire rated assemblies as shown on the Drawings.
- C. Comply with applicable specification recommendations of GA-216 and GA-600 as published by the Gypsum Association.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Comply with GA-216 and Manufacturer's directions.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Maintain temperature of installed gypsum board spaces in range of 55 degrees F. to 90 degrees F. until building is entirely closed, in accordance with Gypsum Association GA-220 and GA 236.
 - 2. Ventilate as required to eliminate excessive moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. CertainTeed Corp., Saint Gobain www.certainteedcorp.com
 2. Georgia-Pacific Gypsum (GP) www.buildgp.com
 3. National Gypsum Company www.nationalgypsum.com
 4. Pabco Gypsum www.pabco gypsum.com
 5. USG www.usg.com

2.02 GYPSUM BOARD MATERIALS

- A. Materials – General: Gypsum board manufactured in or imported from China is Not Permitted.
- B. Standard Gypsum Board: ANSI/ASTM C36 or ASTM C1396; 5/8 inch thick, maximum permissible length; ends square cut, tapered edges. Provide sag-resistant type for ceiling applications.
- C. Fire Rated Gypsum Board: ANSI/ASTM C36 or ASTM C1396; fire resistive type, UL rated; 5/8 inch, maximum permissible length; ends square cut, tapered edges. Provide sag-resistant type for ceiling applications.
- D. Moisture Resistant Gypsum Board: Mold and moisture resistant gypsum board complying with ANSI/ASTM C630 or ASTM C1177, and resistant to mold and mildew per ASTM D3273 and ASTM G21; 5/8 inch thick, maximum permissible length; tapered edges. 5/8 inch fire-resistant rated units where indicated.
1. Acceptable Products:
 - a. M2Tech mold and moisture resistant gypsum board, CertainTeed Corp.
 - b. DensArmor Plus Interior Guard moisture, mold and mildew resistant coated glass mat faced gypsum core panels, Georgia-Pacific Gypsum.
 - c. Gold Bond BRAND XP Gypsum Board, National Gypsum Company.
 - d. Pabco Mold cure Plus, Pabco Gypsum.
 - e. USG Sheetrock Brand Mold Tough Gypsum Panels, USG
- E. Glass-Mat Faced Exterior Gypsum Sheathing Board: As specified in Section 06 16 43 – Exterior Gypsum Sheathing.
- F. Ceramic Tile Backer Board: As specified in Section 09 30 00 - Ceramic Tile.

2.03 ACCESSORIES

- A. Adhesive: ASTM C557.
- B. Acoustical Sealant: As specified in Section 07 92 00.
- C. Corner Beads: GA216; Type CB; electro-galvanized steel.
- D. Edge Trim: GA216; Type L or J bead; electro-galvanized steel and Type LC rolled-formed zinc.
- E. Control Joint: No. 093, roll-formed zinc, as manufactured by U.S.Gypsum, Unimast, or Dietrich.

- F. Joint Materials: ANSI/ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. For coated board and gypsum sheathing, use material recommended by Board Manufacturer.
 - 1. Use 2 inch wide 10 x 10 glass mesh tape at moisture resistant gypsum board.
 - 2. Use only setting type joint compound at moisture resistant gypsum board.
- G. Screws: Steel drill screws conforming to ASTM C1002.
 - 1. Type G for fastening to gypsum board, Type S for fastening to light gauge steel framing and Type W for fastening to wood framing.
 - 2. Nails are not permitted
- H. Drywall Primer:
 - 1. Paint material specifically formulated to fill the pores and equalize the suction difference between gypsum board surface paper and the compound used on finished joints, angles, fastener heads and accessories and over skim coatings.
 - 2. Drywall primer which is applied to the finished surface of the work specified in this section shall be provided as specified under Sections 09 91 00 and 09 72 00 as applicable.
 - 3. A good quality, white latex drywall primer formulated with high binder solids, applied undiluted, and shall be applied to gypsum board surfaces prior to the application of texture materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that site conditions are ready to receive Work and opening dimensions are as instructed by the Manufacturer.
- B. Beginning of installation means acceptance of substrate.

3.02 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA-201, GA-216, and ASTM C840 and Manufacturer's instructions as applicable.
 - 1. Coordinate installation with installation of tile backer board specified in Section 09 30 00 indicated to be used under ceramic tile.
 - 2. Extend tile backer units out a minimum of 12 inches beyond edge of shower surrounds.
 - 3. Provide moisture resistant gypsum board at all "wet" walls and behind all urinals and toilets, extending a minimum of 12 inches beyond edge of urinal or toilet.
- B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
- D. Ceiling Boards:
 - 1. Install gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- E. Use screws when fastening gypsum board to metal framing.
- F. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- G. Place control joints consistent with lines of building spaces as indicated on Drawings and as recommended by Board Manufacturer.
- H. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials. Use J-metal edge where indicated at unfinished gypsum board edges against other finish materials.

3.04 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C. Taping, filling, and sanding is not required at surfaces behind ceramic tile.

3.05 ACOUSTICAL WALLS AND TREATMENT

- A. Install acoustical sealant in accordance with Manufacturer's instructions and Section 07 92 00.
- B. Install acoustical sealant at gypsum board perimeter at:
 - 1. Metal framing: Two beads.
 - 2. Base layer of double layer applications, if applicable.
 - 3. Face layer.
 - 4. Seal all around all gypsum board penetrations by conduit, pipe, ductwork, and rough-in electrical/telephone boxes, etc.
- C. Install acoustical sealant where gypsum board joins other walls or surfaces at sound control partitions.

3.06 FINISHING OF GYPSUM BOARD SURFACES

- A. Provide finish of gypsum board surfaces in accordance with the Gypsum Association "Recommended Specification: Levels of Gypsum Board Finish" as follows as noted on Room Finish Schedule:
 - 1. Level 0 (Temporary Construction): No taping, finishing, or accessories required.
 - 2. Level 1 (Fire Taping at plenum areas above ceiling, in attics, in areas where the assembly will be concealed or in building service corridors and other areas not normally open to public view):
 - a. Joints and interior angles shall have tape embedded in joint compound.
 - b. Surface shall be free of excess joint compound.
 - c. Tool marks and ridges are acceptable.
 - 3. Level 2 (Areas to receive ceramic tile):
 - a. Joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating joint compound over joints and interior angles.
 - b. Fastener heads and accessories shall be covered with a coat of joint compound.
 - c. Surface shall be free of excess joint compound.

- d. Tool marks and ridges are acceptable.
 - e. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
4. Level 3: Not Used.
5. Level 4: Standard level of finish for all Utility, Equipment, Mechanical, Janitor Rooms, and Similar Spaces, unless otherwise indicated or approved by Architect. (Appearance areas to receive flat paints or light texture.) Use Level 5 finish if space is indicated to receive gloss, semi-gloss, or enamel paints:
- a. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles.
 - b. Fastener heads and accessories shall be covered with 3 separate coats of joint compound.
 - c. Joint compound shall be smooth and free of tool marks and ridges.
 - d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
 - e. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in 09 91 00 and 09 72 00, as applicable.
6. Level 5: Typical finish for all locations, except for spaces identified above which may receive Level 4 finish:
- a. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat applied over interior angles.
 - b. Fastener heads and accessories shall be covered with 3 separate coats of joint compound.
 - c. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface to fill imperfections in the joint work, smooth the paper texture and provide a uniform surface for decorating. Excess compound shall be immediately sheared off, leaving a film of skim coating compound completely covering the paper.
 - d. The surface shall be smooth and free of tool marks and ridges.
 - e. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
 - f. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in Sections 09 91 00 and 09 72 00, as applicable.
- B. Surfaces shall be free of dust, dirt and oil and shall received Drywall Primer before application of texture or skim coat as required by the manufacturer of the texture or skim coat materials.
- C. Surface Finish: Produce surface finish to match approved sample, type as indicated below.
- 1. All locations: Smooth finish, unless otherwise indicated on Drawings or approved by Architect.

3.07 CLEANING

- A. After completion of wallboard installation, taping and texturing, remove rubbish, excess material and equipment from building and job site, leaving floors and other surfaces clean.
- B. Remove overspray from adjoining construction.

- C. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

3.08 PROTECTION

- A. Protect Work from damage until acceptance.
- B. Repair or replace damaged Work.

END OF SECTION

SECTION 09 30 00

TILE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes ceramic, mosaic, glass, and similar tile products and installation materials for installation on floors, walls and wall base, as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Section 10 21 16.56 – Precast Shower Bases, for precast terrazzo shower bases.
 - 2. Division 22 – Plumbing, for floor drains and trench drains at locations to receive ceramic tile.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's data for tile and accessory materials, including recommended procedures for mixing materials and setting tile for each application type.
- B. Samples: Submit a minimum of four samples of each type of tile required and associated grout type and manufacturers selection of colors, marked with Manufacturer's name and location where tile is to be installed. Tile and Grout color samples shall be submitted within the same submittal package.
- C. Proposed alternate tile setting methods to those specified for review and approval.

1.03 QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI A-108 Series and the TCNA 2018 "Handbook for Ceramic, Glass, and Stone Tile Installation." Tile shall bear the TCNA grade seal.
- B. Subcontractor's Qualifications: The firm executing the work under this Section shall have five (5) years experience in work of similar scope and nature to that specified.
- C. Blending: Tile Manufacturer to blend tile at the factory.
 - 1. Provide additional blending at the job site as needed to obtain the Architect's approval.
- D. Static Coefficient of Friction: Provide floor tile products and finished floor tile installation with a wet DCOF of 0.42 or greater when tested with the BOT-3000 using SLS solution per procedures in ANSI A137.1.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver manufactured materials in original, unbroken containers bearing name of Manufacturer, brand and grade seals. Keep materials dry, clean and protected against deterioration.

1.05 MAINTENANCE

- A. Extra Materials: Furnish one (1) square foot of tile for each 100 square feet of each color and size of tile and grouting materials used in the Project. If less than 100 square feet is installed, provide a minimum of four (4) square foot of extra stock for each tile type and color. Extra materials shall be furnished in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as otherwise approved by the Architect, subject to compliance with Specification requirements.
 - 1. Tile Products: Provide tile products of manufacturer's indicated on Drawings or as otherwise selected by Architect and/or Owner.
 - 2. Setting and Grouting Materials:
 - a. Bostik – Hydroment www.bostik-us.com
 - b. C-Cure, as mfrd by Bonded Materials Company www.c-cure.com
 - c. Custom Building Products www.custombuildingproducts.com
 - d. Laticrete www.laticrete.com
 - e. MAPEI Corporation www.mapei.com
 - f. Tec Specialty Products, Inc., an H.B. Fuller comp. www.tecspecialty.com

2.02 TILE MATERIALS

- A. Ceramic, Porcelain, Glass, Mosaic and Other Tile: As scheduled on Drawings.
- B. Trim Shapes: Provide Manufacturer's full selection of trim shapes as required
 - 1. Provide all bases, caps, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
 - 2. Except as may be shown otherwise on the Drawings, provide color and finish matching the adjacent tile.

2.03 INSTALLATION MATERIALS

- A. Mortar for Thin Set Installation: Stain-resistant, latex modified portland cement mortar per A118.4 and applicable TCNA Method.
- B. Grout: All grout shall be stain resistant type.
 - 1. Latex grout: Conforming to ANSI 118.6 and the TCNA Handbook, by an approved Manufacturer. Grout shall be sealed as recommended by manufacturer.
 - 2. Epoxy grout: Chemical-resistant per ANSI 118.3, water-cleanable during installation, by an approved Manufacturer. Epoxy grout is required at all wet areas.
 - 3. Color(s): As scheduled on Drawings or as otherwise selected by Architect.

2.04 ACCESSORIES

- A. Ceramic Tile Backer Units: Provide one of the following. Furnish units with manufacturer's recommended joint tape. Moisture resistant gypsum board is not allowed as a substrate for tile.
1. Cement Backer Board: Provide cementitious backer units complying with ANSI 118.9.
 - a. Thickness: 1/2 inch. Provide 5/8 inch Type X where tile backer units are part of a fire rated partition assembly.
 - b. Subject to compliance with requirements, provide one of the following:
 - 1) C-Cure; C-Cure Board 990.
 - 2) Custom Building Products; Wonderboard.
 - 3) Fin Pan Inc., Util-A-Crete Concrete Backer Board.
 - 4) USG Corporation; DUROCK Cement Board.
 2. Fiberglass-Mat Faced Gypsum Backing Board: ASTM C1178:
 - a. Thickness: 1/2 inch. Provide 5/8 inch Fireguard Type X where tile backer units are part of a fire rated partition assembly.
 - b. Edges: Square.
 - c. Surfacing: Coated fiberglass mat on face, back, and long edges.
 - d. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
 - e. Permeance (ASTM E96): Not more than 1.0 perms when tiled.
 - f. Acceptable Products:
 - g. Subject to compliance with requirements, provide the following:
 - 1) 1/2 inch DensShield or 5/8 inch DensShield Fireguard Type X, Georgia-Pacific Gypsum.
- B. Expansion/Control Joint Backing Material: Provide closed cell polyethylene foam weighing not less than 2.7 lbs. per cubic feet, and in dimension approximately 20 percent thicker than width of the expansion joint in which used.
- C. Expansion/Control Joint Sealant: Provide in colors selected by the Architect, complying with requirements of Section 07 92 00.
1. At joints between floors and walls, and at perimeter of metal door frames, provide one-part low modulus moisture cure silicone rubber sealant conforming to FS TT-S-001543A, Class A, FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O.
 2. At joints in traffic areas, and at perimeter joints, provide two-part polyurethane material conforming to ASTM C920, Type M, Grade P, Class 25, Use T, with Shore A hardness of 35 - 45.
- D. Edge and Transition Strips: Solid brass, extruded aluminum, or roll-formed stainless steel edge and transition strips, height and/or size as indicated; with integral perforated anchoring leg for setting the strip into the setting material. Refer to Drawings for locations.
1. Height: As required to suit application, flush with finished floor/wall surface.
 2. Finish: As indicated on Interior Drawings and Specifications, or as selected by Architect.
 3. Products: Subject to compliance with specification requirements, provide one of the following as selected by Architect, unless otherwise indicated on Drawings:
 - a. Schlüter – QUADDEC/-K, SCHIENE, DECO, RENO, or DILEX as indicated on Interior Drawings and Specifications or as selected by Architect.

- E. Waterproofing and Crack Isolation Membrane: Provide one of the following:
 - 1. Laticrete Blue 92 Anti-Fracture Membrane, or Laticrete Hydro Ban Waterproofing and Crack Isolation Membrane; Laticrete International.
 - 2. RedGard Waterproofing and Crack Prevention Membrane, Custom Building Products.
 - 3. UltraCure 971 Elastomeric Waterproofing and Crack Isolation Membrane, C-Cure.
- F. Prefabricated Precast Terrazzo Shower Bases: As specified in Section 10 21 16.56.
- G. Tile and Grout Sealer: Colorless, penetrating, stain-resistant sealer recommended tile and grout manufacturers for type of tile and grout indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine subsurfaces to receive Work and report detrimental conditions in writing. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordinate with other Work which affects, connects with or is concealed by this Work. Before proceeding, make certain required inspections have been made.
- C. Where tile units will be thin-set directly to the substrata, do not commence installation of the tile units until substrata are within the following tolerances:
 - 1. Horizontal surfaces: Level within 1/8 inch in ten feet in all directions;
 - 2. Vertical surfaces: Level within 1/8 inch in eight feet in all directions.
 - 3. Deflection:
 - a. Horizontal Surfaces: Less than 1/360 of the span.
 - b. Vertical Surfaces: Verify that design of the wall or partition will not permit deflection exceeding 1/360 of the span for point and uniform loading. Space wood or metal studs not less than 16 inches on centers.
- D. Fill low spots and grind or sand high spots to provide required tolerances. Use latex modified Portland cement based trowelable leveling and patching compound to fill holes, cracks and depressions in accordance with tile setting materials printed instructions.
- E. Conditions of Surfaces to Receive Tile:
 - 1. Verify that surfaces to receive tile are firm, dry clean, and free from oily or waxy films and curing compounds.
 - 2. Verify that grounds, anchors, plugs, recess frames, bucks, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of tile.
 - 3. Scarify hard steel trowel finish concrete surfaces.
 - 4. Completely remove curing compounds on concrete surfaces by scarification or cleaning methods acceptable to tile setting materials manufacturer.

3.02 PREPARATION

- A. Lay out Work so that no tile of less than half size occurs.
 - 1. For heights stated in feet and inches, maintain full courses to produce nearest attainable heights without cutting tile.

2. Align joints in wall tile vertically and horizontally except where other patterns are shown or specified. Align joints in walls to conform to patterns selected.
 3. Align joints in floor tile at right angles to each other and straight with walls and conform to patterns selected or indicated.
- B. Obtain Architects and/or Owners approval of tile layouts for each area prior to installation, typical for all areas.
- C. Obtain exact locations of expansion joints and accessories before installing tile.
- D. Locate accessories in tile walls as indicated on Drawings or as directed by Architect. Where the size of accessory does not line up with the jointing pattern of adjacent tile, the cutting of tile and arrangement of joints around the accessories shall be as directed by Architect.

3.03 INSTALLATION

- A. Install tile backer board at wet walls and other locations where indicated and as follows:
1. Install cement backer board and treat joints in accordance with ANSI A108.11, manufacturer's recommendations and TCNA Setting methods specified.
 2. Install glass-mat faced gypsum backing board in accordance with ASTM C840, manufacturer's recommendations, and TCNA Setting methods specified.
- B. Tile –General:
1. Install tile in accordance with ANSI Specifications A108.1 through A118.1 and Manufacturer's recommendations.
 2. Cut and drill neatly as required without marring tile. Rub smooth necessary cuts with a fine stone. Set cut edge against fixture, cabinet or other tile with joint at least 1/16-inch wide.
 3. Joint Widths: Install tile with joint widths indicated on Drawings, or as selected by Architect and/or Interior Designer for various tile types, sizes and applications.
- C. Prefabricated Precast Terrazzo Shower Bases: Installed as specified in Section 10 21 16.56.
- D. Crack Isolation Membrane: Install waterproofing and crack isolation membrane over cracks and sawcuts up to 1/8 inch in width in concrete slab in accordance with Manufacturer's printed instructions. Sawcut joints over 1/8 inch shall be treated as control joints.
- D. Substrate Construction, Expansion, Control Joints, and Isolation Joints: Do not bridge joints which are designed to experience movement. Carry these types of joints through the mortar and tile installation materials.
1. Where waterproofing is specified, clean the joint and install open or closed cell backer rod to the proper depth as outlined in TCNA EJ171 Guidelines.
 2. Compress sealant as specified in Section 07 92 00 into the joint, coating the sides and leaving it flush with the surface.
 3. After the sealant is dry, place bond breaker tape over the joint.
 4. Apply waterproofing membrane over joint and substrate in accordance with manufacturer's printed instructions.
 5. Install tile onto the membrane, but do not bridge the joint.
 6. After tile is properly set, fill joint as specified herein under Tile Expansion and Control Joint Sealant article.

- E. Waterproofing Membrane: Install waterproofing and crack isolation membrane at all wet areas and as indicated on Drawings. Install in accordance with Manufacturer's printed instructions. Utilize where membrane is required beneath tile at floors or walls in wet areas. Waterproof coves at wet areas in accordance with Manufacturer's recommendations to a minimum height of 8 inches above floor. Allow membrane to cure before applying bonding materials.
- F. Thin Set: Where indicated to be thin-set, install tile using TCNA Method for substrate condition and type for latex-Portland cement mortar, and as follows:
1. Floors: TCNA F113 at interior slab on grade construction. TCNA F125 at concrete floors with cracks using crack isolation membrane. Full or partial coverage as required by extent of cracks.
 2. Wet Area Floors: TCNA F122 using epoxy grout at wet area interior slab on grade construction. Use TCNA F125 at wet area floors with cracks using waterproofing and crack isolation membrane. Install epoxy grout in accordance with TCNA F115.
 3. Walls (dry): TCNA W244 C or F, or W243 typical dry area walls. Use white color thin-set mortar for glass tile installations.
 4. Walls (wet): TCNA W244C or W245 (as appropriate to type of tile backer board used) with waterproofing membrane at wet area walls over tile backer board ("wet" or plumbing walls including showers, tubs and other wet walls).
 5. Submit any proposed alternate setting methods to Architect for review and approval prior to installation. Include product and installation instructions for any proposed alternate setting materials.
- G. Grout:
1. Mix grout to a creamy consistency.
 2. Mix only as much grout as can be used in one hour.
 3. Thoroughly force into joints, fill entire depth.
 4. Finished surface of joints shall be uniformly smooth, and continuously level with edges of tile.
- H. Expansion and Control Joint Sealant:
1. Workmanship for caulking and sealants shall conform to requirements of Section 07 92 00.
 2. Provide expansion/control joints in accordance with TCNA EJ171 and where indicated on Drawings, and:
 - a. Interior: 20'-0" to 25'-0" in each direction, except provide joints at 8'-0" to 12'-0" in each direction at areas exposed to direct sunlight or moisture and at above ground concrete slab substrates.
 3. Joints between tile and door frames and other metal accessories, tile and ceiling, wall tile and wall tile at inside corners and wall tile and floor tile shall be sealed with silicone rubber sealant.
 4. Provide expansion joints at tile columns, curbs and pipes and fill with sealant. At building structural joints extend expansion joints through the tile. Seal with sealant. In no case shall tile be carried over expansion joints without a joint in the tile.
- I. Seal tile and grout in accordance with Manufacturer's recommendations.

3.04 CURING

- A. Damp cure all cement based tile installations, including Portland cement grouts, for 72 hours minimum.
1. Cover with clean non-staining 40-pound Kraft paper.

2. Do not use polyethylene sheets directly over tile on horizontal surfaces.
3. Keep all traffic off newly installed floors for at least 72 hours. Protection may be necessary.

3.05 TOLERANCES

- A. Tile: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignments shown:
 1. Horizontal surfaces: 1/8 inch in 10'-0" in all directions;
 2. Vertical surfaces: 1/8 inch in 8'-0" in all directions.
 3. Lippage: 1/8 inch maximum.
 4. Maximum Variation of Joint Width: 1/16 inch at tile with joints up to 1/4 inch in width, 1/8 inch at tile with joints over 1/4 inch in width.

3.06 CLEANING

- A. Wipe surfaces clean after grouting, remove traces of mortar and grout. Do not use acid solution for cleaning glazed tile.
- B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

3.07 PROTECTION

- A. Close spaces to traffic or other Work until tile is firmly set. Protect from damage until acceptance. Repair damaged Work at no additional cost to Owner.
- B. Prohibit foot and wheel traffic from using newly tiled floors for at least 7 days. Place large, flat boards in walkways and wheelways where use of newly tiled floor is unavoidable.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes acoustical panel ceilings including exposed grid suspension system, wire hangers, main runners, cross tees, wall angle moldings and accessories as shown on Drawings and as specified herein.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing complete layout of systems including attachments, intersections of members and edge conditions.
- B. Product Data: Provide data on metal grid system components and each acoustical panel, including manufacturer's certificate that products meet or exceed specified requirements.
- C. Samples:
 - 1. Submit 2 samples of each type of unit specified, minimum of 6 inches x 6 inches, including color selection when applicable.
 - 2. Submit samples of Manufacturer's full color selection for selection by Architect.

1.03 QUALITY ASSURANCE

- A. Qualifications: Installer shall be approved by Manufacturer of material or system.
- B. Standards: Comply with the following:
 - 1. ASTM C635, "Standard Specification for Acoustical Tile and Lay-In Panel Ceilings."
 - 2. ASTM C636, "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels."
 - 3. ASTM E580, "Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions."
 - 4. Ceilings and Interior Systems Construction Association (CISCA) "Recommendations for Direct-Hung Acoustical tile and Lay-in Panel Ceilings."
 - 5. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical tile and Lay-in Panel Ceilings, for seismic zone/class indicated on General Structural Notes on Drawings.
 - 6. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- C. Surface Burning Characteristics: Class A per ASTM E1264 and Fed. Spec. SS-S-118B, Flame Spread 25 or under, per ASTM E-84 (UL Label).
- D. Provide acoustical ceiling system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) ratings as specified.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install ceiling panels until building is closed in and HVAC system has been in operation for a minimum of 48 hours with ambient temperature and humidity conditions maintained at the levels indicated for the Project when occupied for its intended use.
 - 2. Locate materials onsite, in areas where units will be installed, at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

1.06 MAINTENANCE

- A. Extra Materials: Provide an additional six (6) panels of each type of acoustical and/or specialty/decorative unit installed, in labeled cartons, to the Owner at completion of Work, for his maintenance use, at no additional cost. Provide, at minimum, one full carton of each type of acoustical unit.

1.07 WARRANTY

- A. Provide manufacturer's standard warranties agreeing to repair or replace acoustical panels and suspension systems that fail within the warranty period. Failures include manufacturing defect, sagging and warping of acoustical panels, and rusting of grid system.
 - a. Warranty Period:
 - 1. Acoustical Panels: Manufacturer's standard maximum warranty for each type of panel used.
 - 2. Grid and Suspension System: Manufacturer's standard maximum warranty, but not less than 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements.
 - 1. Armstrong World Industries www.ceiling.com
 - 2. Chicago Metallic Corporation (for suspension system) www.chicago-metallic.com
 - 3. USG Interiors, Inc. www.usg.com
 - 4. Certainteed Saint Gobain www.certainteed.com

2.02 SUSPENSION SYSTEM

- A. Ceiling Suspension System: Intermediate duty with components formed from commercial quality cold rolled steel electro-zinc coated.
 - 1. Main-Runners: Minimum of 1-1/2 inch in height with an exposed capped face of width of 15/16 or as otherwise indicated on Drawings.
 - 2. Cross-Tees: Minimum of 1-1/4 inches or 1-1/2 inches in height with an exposed capped face in a width and profile to match main runners.
 - 3. Finish: Exposed faces of main and cross runners shall be a baked enamel paint finish, Colors as follows:
 - a. White, unless otherwise indicated on Drawings.
- B. Hanger Wire: Galvanized steel conforming to Federal Specification FF-QQ-W-461, Finish 5, Class 1 annealed, and not less than 12 gauge).
- C. Suspension system shall support the ceiling system specified with a maximum deflection of 1/360 of the span.
- D. Wall and Penetration Moldings: 24 MSG painted steel with a minimum one inch wide lower flange, finish and configuration to match grid. For circular penetrations and/or curved walls/soffits provide edge molding manufactured to exact diameter of circular penetration or flexible vinyl edge trim capable of curving to exact diameter of wall or penetration without distortion.
- E. Compression Struts: C-shaped steel stud in compliance with Section 09 22 16. Provide in minimum thickness as required to adequately resist the vertical component induced by the bracing wires.
- F. Hold-Down Clips: Provide access type hold-down clips where required by Acoustical Ceiling Manufacturer for type and condition and where panels weigh less than one pound per square foot.

2.03 CEILING PANELS

- A. Acoustical Ceiling Panels: Provide panel products matching Manufacturer's designations indicated on Drawings and complying with the following:
 - 1. Light reflectance of LR-1 (over 75 percent), per Fed. Spec. SS-S-118B and ASTM E1264 for factory finished panels. Field painted panels are not required to comply.
 - 2. Size: As indicated on Drawings.
- B. Gypsum Core Lay-in Panels: Provide the following at Kitchen and Food Preparation Areas, unless otherwise scheduled on Drawings:
 - 1. Sheetrock Brand ClimaPlus Vinyl #3270, or equivalent as selected by Architect from one of the specified manufacturers.
 - 2. Finish: Vinyl faced and backed gypsum core with sealed edges.
 - 3. ASTM E1264 Classification: Type XX, Pattern G.
 - 3. Size: 24 inch x 48 inch x 1/2 inch.
 - 4. Light reflectance: .77 per ASTM E1264.
 - 5. NRC: .10 in suspended mounting.
 - 6. CAC: 40 (continuous ceiling).
 - 7. USDA approved for use in food preparation areas.
 - 8. Edge Detail: Square.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing, with a copy to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Verify, before proceeding with this Work, that required inspections of existing conditions have been completed.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance the following:
 - 1. ASTM C635, ASTM C636 and as supplemented in this Section.
 - 2. ASTM E580, "Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions."
 - 3. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical tile and Lay-in Panel Ceilings, for seismic zone/class indicated on General Structural Notes on Drawings.
 - 4. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
 - 5. 2012 IBC Chapter 8 installation requirements and Chapter 16 requirements for suspended ceilings for Seismic Design Category indicated in General Structural Notes on Drawings for location where project is located.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum. Individual component deflection shall not exceed 1/360 of span.
- C. Locate system on room axis according to reflected ceiling plan. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.
- D. Install after major above-ceiling Work is complete. Coordinate the location of hangers with other Work.
- E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- F. Hanger Wire Installation: Secure hanger wires to upper structural elements above. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for the supporting structural member, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures. Tie wires with a minimum of three tight turns and space hangers so that each hanger wire supports a maximum of 16 sq. ft. Lay-out as reflected and dimensioned in reflected ceiling plan.
- G. Laterally brace and seismic stabilizer bars, struts and clips as required to comply with Seismic design requirements.

- H. Hang suspension system independent of walls, columns, ducts, pipes, conduit, and other obstructions. Where required, provide additional suspended structural members to form "trapeze" to span underside of ductwork or other obstruction, with main suspension of ceiling system suspended from the additional members.
 - 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- I. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- J. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- K. Do not eccentrically load system, or produce rotation of runners.
- L. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Fit border trim neatly against abutting surfaces.
- M. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- N. Install protection over light fixtures in accordance with UL assembly requirements, where required.

3.03 INSTALLATION - ACOUSTICAL LAY-IN UNITS

- A. Material shall be dry and clean at time of application.
- B. Install acoustical units in accordance with Manufacturer's instructions, and as specified herein.
- C. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- D. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces. Where recommended by Manufacturer, use tiles one at a time from at least four open boxes to avoid creating any pattern due to slight variations from box to box.
- E. Install units after above-ceiling Work is complete.
- F. Install acoustical units level in uniform plane, and free from twist, warp and dents.
- G. Cut panels to fit irregular grid and perimeter edge trim. Field rabbet panel edge. Double cut and field paint exposed edges of reveal edge units.
- H. Where round obstructions occur, provide preformed closers to match edge molding.
- I. Field paint cut edges to match surface color and sheen.

3.04 INSTALLATION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.05 ADJUSTING

- A. Remove damaged or soiled panels and replace with new units, as directed by Architect.
- B. 'Touch-up' minor abraded surfaces.

3.06 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 09 65 13

RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Resilient wall base.
 - 2. Adhesives and other related installation materials as necessary.

1.02 SUBMITTALS

- A. Product Data: Submit data on specific products, describing physical and performance characteristics, sizes, patterns and colors available.
- B. Samples: Submit 2 samples of each material specified illustrating color and pattern.

1.03 QUALITY ASSURANCE

- A. Qualifications: Installation shall be by qualified installer approved by the Manufacturer of the materials.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Installation shall not begin until Work of other Trades is substantially completed and the area or rooms where flooring is to be installed has been maintained at a minimum temperature of 70 degrees F. for at least 48 hours.
- B. Maintain ambient temperature required by Adhesive Manufacturer three days prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wall Base and Flooring Accessories: Furnish products of one of the specified Manufacturers, except as otherwise approved by the Architect, subject to compliance with Specification requirements.
 - 1. Johnsonite www.johnsonite.com
 - 2. No substitutions unless otherwise prior approved by Architect.

2.02 BASE

- A. Base: ASTM F1861.
 - 1. Material: Type TV thermoplastic vinyl, unless otherwise scheduled Drawings.
 - 2. Height: 4 inches, unless otherwise scheduled on Drawings.
 - 3. Thickness: 1/8 inch thick
 - 4. Length: Coils/Rolls in manufacturer's standard lengths. Cut lengths are not allowed.
 - 5. Type: Top set, coved typical, toeless at carpet.
 - 6. Color: As scheduled on Room Finish Schedule on Drawings, or as otherwise selected by Architect from manufacturer's full line of colors.
- B. Base Accessories: Premolded end stops and external corners of same material, size, and color as base.

2.03 ACCESSORIES

- A. Adhesives: Suitable for substrate conditions involved as recommended by the Manufacturer of the resilient base and accessory materials. Adhesives shall be waterproof, stabilized type. Asphalt emulsions are not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

3.02 PREPARATION

- A. Remove substrate ridges and bumps and vacuum substrate to condition acceptable to receive adhesive.

3.03 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.04 CLEANING

- A. Remove dirt, debris and adhesive from wall base and adjacent surfaces using Manufacturers recommended methods and leave installation in a clean, undamaged condition.
- C. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 09 65 60

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Resilient Athletic Flooring, including recycled rubber roll/sheet flooring.
- B. Related Sections:
 - 1. Concrete Substrate: Section 03 30 00 Cast-In-Place Concrete.

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide recycled rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.03 SUBMITTALS

- A. Product Data: Submit product data, including manufacturer's guide specifications product sheet, for specified products.
- B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.
- C. Samples: Submit selection and verification samples for finishes, colors and textures.
- D. Quality Assurance Submittals: Submit the following:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- E. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
- G. Closeout Submittals: Submit the following:
 - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
- H. Warranty: Warranty documents specified herein.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

- B. **Manufacturer's Qualifications:** Manufacturer capable of providing field service representation during construction and approving application method.
- C. **Mock-Ups:** Install at project site a job mock-up using acceptable products and manufacturer-approved installation methods. Obtain Architect's approval of finish color, texture and pattern, and workmanship standard.
 - 1. **Mock-Up Size and Location:** As directed by the Architect.
 - 2. **Maintenance:** Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 3. **Incorporation:** Approved mock-up may be incorporated into final construction upon Owner's approval.
- D. **Preinstallation Meetings:** Conduct preinstallation meeting at the site to verify project requirements, substrate conditions, manufacturer's instructions and manufacturer's warranty requirements. Meeting shall include, at a minimum, the Contractor, the flooring installer, flooring manufacturer and installers of related materials. Architect shall be notified of the date and time of the meeting not less than one week prior to meeting.

1.05 DELIVERY, STORAGE & HANDLING

- A. **Ordering:** Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. **Delivery:** Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. **Storage and Protection:** Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.06 PROJECT CONDITIONS

- A. **Temperature Requirements:** Maintain air temperature in spaces where products will be installed for time period before, during and after installation as recommended by manufacturer.
- B. **Field Measurements:** Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 WARRANTY

- A. **Manufacturer's Warranty:** Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under Contract Documents.
- C. **Warranty Period:** 5 years commencing in Date of Substantial Completion.

1.08 MAINTENANCE

- A. **Extra Materials:** Deliver to Owner extra materials from same production run as products installed.

- B. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals (Maintenance Materials) Section.
 - 1. Quantity: Furnish quantity of recycled rubber flooring units equal to 5 % of amount installed.
- C. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PART 2 PRODUCTS

2.01 Resilient Athletic Flooring

- A. Manufacturer: ECO Surface Commercial Flooring; manufactured in the USA by ECORE International; www.ecosurfaces.com
- B. Flooring: ECOsurfaces Recycled Rubber Resilient Flooring:
 - 1. Roll Size:
 - a. Width: 48 inches.
 - b. Thickness: 1/4 inch.
 - b. Length: 50 linear feet
 - 2. Colors: As selected by Architect.
- C. Product Testing:
 - 1. Tensile Strength, lb/ sq. in. (ASTM D412): 200 min.
 - 2. Flexibility, 1/4 inch mandrel (ASTM F137): pass
 - 3. Static Load, 400 lbs (ASTM F970): less than 0.005 inch.
 - 4. Coefficient of Friction (ASTM D2047): greater than 0.9
 - 5. Chemical Resistance (ASTM F925): slight change.
 - 6. Noise Reduction (ASTM C423): 0.05 sabine per sq. ft.
 - 7. Thermal Conductivity (ASTM C518): 0.445 Btu-in per hr-sq. ft. –deg F.
 - 8. Impact Insulation Class (ASTM E492): 48
 - 9. Sound Transmission Coefficient (ASTM E413): 51
 - 10. Sustainability (ASTM E2129): data collected.
 - 11. CHPS Section 01350 (ASTM D5116): Pass.

2.02 ACCESSORIES

- A. Adhesives: Suitable for the underfloor substrate conditions involved as recommended by the Manufacturer of the flooring materials. Adhesives shall be waterproof, stabilized type.

2.03 SOURCE QUALITY

- A. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Surface Preparation: [Specify applicable product preparation requirements.].

3.04 INSTALLATION

- A. Recycled Rubber Flooring Installation: Comply with Flooring Manufacturer's Technical Manual for installation procedures and techniques for flooring installation.

3.05 FIELD QUALITY REQUIREMENTS

- A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.07 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 09 77 33

FRP WALL PANELS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Product Data: Manufacturer's Specifications and installation instructions for each material and accessory.
- B. Submit Manufacturer's full range of color and pattern samples of wall panels and trim pieces for Architect's selection. Submit two samples of selected products.
- C. Submit cleaning and maintenance instructions in accordance with Section 01 77 00.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials clearly labeled to identify Manufacturer, brand name, quality or grade and fire hazard classification.
- B. Store horizontally in original undamaged packages.

1.03 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Install materials when temperature and humidity conditions approximate conditions that will exist when building is occupied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the specified Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 - 1. Crane Composites, Inc. (Kemlite), Channahon, IL (800) 435-0080 www.kemlite.com
 - 2. Glasteel www.glasteel.com ; Stabilit / Resolite Company.
 - 3. Marlite, Inc., Dover, OH (303) 343-6621 www.marlite.com

2.02 MATERIALS

- A. FRP Panels: Fiberglass reinforced plastic panels complying with the following:
 - 1. Class: Class I (A) FR panels.
 - 2. Thickness: 0.090.
 - 3. Texture: Embossed pebble texture.
 - 4. Color: Color as scheduled on Finish Schedule on Drawings.
- B. Adhesive for panel installation: Manufacturer's recommended type for use with selected materials, waterproof, mildew resistant nonstaining type.
- C. Edge Sealant: Type "E" clear mildew resistant silicone sealant as specified in Section 07 92 00, or mildew resistant sealant recommended by manufacturer for sealing panel edges and moldings.

- D. Moldings: All molding shall be 1-piece vinyl of the following types, color to match FRP.
 - 1. Panel Edges: "J" type Cap molding.
 - 2. Panel to Panel: "H" type Division Bar molding.
 - 3. Inside Corner: "J" type Inside Corner molding with radius edge.
 - 4. Outside Corner: "J" type Outside Corner molding with extended leg.
 - 5. Ceiling: "J" type Ceiling molding with radius edge, or use inside corner molding.
- E. Fasteners: Manufacturer's standard nylon drive pins.
- F. Miscellaneous Items: Furnish and install supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation whether or not specified or indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine substrate and conditions under which the material is to be installed.
 - 2. Verify that surfaces, when tested with moisture meter, have proper moisture content.
 - 3. Verify that nails and screws are recessed, with joints and depressions taped, finish and sealed.
 - 4. Remove contaminants from areas to be covered.
 - 5. Do not proceed with Work until Work of other Trades which passes through wall covering has been completed and unsatisfactory conditions have been corrected.
 - 6. Start of Work indicates acceptance of responsibility for performance and any required remedial Work.

3.02 INSTALLATION

- A. Install panels in accordance with Manufacturer's printed instructions using full sheet mastic coverage method plus nylon fasteners.
- B. Make joints with 1/8 inch space for expansion and use moldings designed for each condition for the Project.
- C. Bevel back edges of panels with block plane to permit proper fit into moldings.
- D. Place a continuous bead of sealant in the receiver channel of all moldings immediately prior to installation of FRP panels. Place continuous bead of sealant at all edges and tool to smooth, slightly concave shape.
- E. If one end of panel must be mechanically fastened, do not fasten the other end.
- F. Remove plumbing escutcheons, switchplates, wall plates, and surface-mounted fixtures, and cut wall paneling evenly to fit. Replace items after completion of Work.
- G. Where applicable, install paneling before installation of plumbing, casings, bases, cabinets and other items to be applied over paneling.

3.03 CLEANING

- A. Remove excess adhesive and smudges with soft cloth and mineral spirits.

END OF SECTION

SECTION 09 81 00
ACOUSTICAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Acoustical insulation above ceilings and within partitions as shown on Drawings and as specified.

1.02 SUBMITTALS

- A. Product data: Submit Manufacturer's data, installation instructions, limitations and recommendations. Include certification and test data substantiating combustibility of each type of insulation.

1.03 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with fire-test-response characteristics as required by code, as determined by testing identical products per ASTM E84 for surface-burning characteristics, by UL or another testing and inspection agency acceptable to authorities having jurisdiction. Identify material with appropriate markings of applicable testing and inspection agency.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the specified Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 1. CertainTeed Corp., Saint Gobain www.certainteed.com
 2. Johns Manville Building Products Group www.johnsmanville.com
 3. Knauf Insulation www.knaufinsulation.com
 4. Owens Corning Fiberglas www.owenscorning.com

2.02 MATERIALS

- A. Sound Attenuation Blankets: ASTM C665, Type 1 (unfaced).
 1. Thickness: 3-1/2 inches, unless otherwise indicated on Drawings.
 2. Surface Burning Characteristics: When tested in accordance with ASTM E84.
 - a. Maximum Flame Spread: 25.
 - b. Maximum Smoke Developed: 50.
 3. Fire Resistance Ratings: Passes ASTM E119 as part of a complete fire tested wall assembly.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.
- C. Clean substrates and voids where insulation will be placed of substances harmful to insulation.

3.02 INSTALLATION

- A. Install acoustical insulation batts in sound-rated stud partition walls where indicated on Drawings. Size batts for a friction fit and install in accordance with Manufacturer's printed instructions.
- B. Install acoustical insulation batts above lay-in ceilings, and other locations as shown on Drawings, in strict accordance with Manufacturer's printed instructions.
- C. Butt ends of batts closely together and fill all voids.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Painting as specified and as noted on Drawings.
 - 2. Surfaces requiring finishing and left unfinished by the requirements of other Sections shall be painted or finished as part of the Work of this Section.
- B. Related Sections:
 - 1. Section 07 19 00 – Water Repellents, for penetrating water repellent coating applied to exposed exterior CMU wall construction.
 - 2. Section 32 17 23 – Pavement Markings, for traffic marking and striping for pavement and curbs.

1.02 DEFINITIONS

- A. Touch-Up: Painting of items missed by painter at no additional cost to Owner.
- B. Re-Paint: Repairs to paint work for damages caused by other trades.
- C. Properly Painted Surfaces: Surface that is uniform in appearance, color, and sheen, and free of foreign material, lumps, skins, runs, sags, holidays, misses, strike-through, and insufficient coverage. Surface free of drips, splatters, spills, and overspray caused by Paint Applicator. Compliance will be determined when viewed without magnification at a distance of 5 feet minimum under normal lighting conditions and from normal veiling position (MPI(a), PDCA P1.92).
- D. Damage Caused by Others: Damage caused by individuals other than those under direct control of Painting Applicator (MPI(a), PDCA P1.92).
- E. Latent Damage: Damage or conditions beyond control of Painting Applicator caused by conditions not apparent at time of initial painting or coating work.

1.03 SUBMITTALS

- A. Product Data: Submit schedule of manufacturers of products required for the Work, together with specifications recommended by each manufacturer.
- B. Samples: Submit samples of each type of finish specified.
 - 1. Architect will furnish Contractor a color schedule of colors selected either from manufacturer's stock colors or specially requested color mixes before Work is begun.
 - 2. Submit two 8 inch x 10 inch samples of each color, including the correct sheen and texture, on heavy cardboard or masonry. Submit sealer and stain finishes on material of the same quality and species of wood on which that particular finish shall be used. Rejected samples shall be resubmitted until approved.
 - 3. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered, until final color approval.

1.04 QUALITY ASSURANCE

- A. Standards: Preparation, application and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
 - 1. Master Painters Institute (MPI) Architectural Painting Specification Manual.
 - 2. Gypsum Association - GA210, "Gypsum Board for Walls and Ceilings."
- B. MPI Grade: All work shall be performed in accordance with MPI Premium Grade finish requirements.
- C. Design Criteria: Systems specified are in addition to prime coats provided under other Specification Sections of the Project Manual.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's sealed original containers with Manufacturer's original legends and labels intact on each container. Deliver amount of materials necessary to meet Project requirements in single shipment.
- B. Storage: Store materials in a single location.
 - 1. Adequately protect against damage while stored at site.
 - 2. In no case shall the amount or method of materials stored exceed the amount permitted or the manner allowed by local ordinances, state laws, or fire underwriter regulations.
 - 3. Keep storage area clean and rectify any damage to area at completion of work of this Section. Maintain storage area at 55 deg. F minimum.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Do not apply exterior paint in damp or rainy weather or until after the surface has dried thoroughly from the effects of such weather.
 - 1. Perform painting operations at temperature and humidity conditions recommended by Manufacturer for each operation and for each product.
 - 2. Do not apply varnish or paint when temperature is below 50 degrees F.. Avoid painting surfaces exposed to hot sunlight.
 - 3. During interior application, maintain minimum temperature of 65 degrees F. unless otherwise directed by Architect or manufacturer's printed instructions. Hold temperature as constant as possible.
 - 4. Provide adequate ventilation at all times so the humidity cannot rise above the dew point of the coldest surface to be painted.
 - 5. Moisture-containing surfaces, such as concrete, stucco and cement plaster shall have a moisture content of less than 8 percent as measured by moisture meter. Remove surface salt deposits prior to painting. Verify that pH is neutral, or within acceptable limits of Paint Manufacturer. Paint after thoroughly cured.
 - 6. Apply painting systems at lighting level of 540 Lux (50 foot candles) minimum on surfaces to be painted. Inspection of painting work shall take place under same lighting conditions as application. If painting and coating work is applied under temporary lighting, deficiencies discovered upon installation of permanent lighting will be considered latent damage as defined in Article 1.02 of this Section and the MPI Architectural Painting Specification Manual.

1.07 MAINTENANCE

- A. Extra Materials: Provide painting materials in Manufacturer's original containers with originals labels intact, in each color and or sheen used. Upon completion of the Work, furnish Owner with one fresh gallon of each type and color of paint and finish used on this Project, including primers and undercoats used. Label containers with manufacturer's name, batch, date, color name, anticipated shelf life, mixture instructions, and cautions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, except as otherwise approved by Architect, subject to compliance with specification requirements.
 1. Benjamin Moore www.benjaminmoore.com
 2. Dunn-Edwards Corporation www.dunnedwards.com
 3. Frazee Paint Company www.frazeepaint.com (a Sherwin Williams Company)
 4. Glidden Professional (ICI) www.gliddenprofessional.com
 5. PPG Paints www.ppg.com
 6. Sherwin Williams www.sherwin-williams.com
 7. Tnemec www.tnemec.com

2.02 MATERIALS

- A. Materials used for any painting system shall be from a single manufacturer, unless approved otherwise in writing by painting system manufacturer. Include such approvals in Product Data submittal.
- B. Provide materials in accordance with the Schedule of Paint Products at the end of this Section as applicable to project. Contractor shall provide either waterborne or solventborne products at contractor's option and as follows:
 1. Waterborne:
 - a. Provide where low odor and fast dry are desired.
 - b. Non-blocking materials shall be used for doors, door jambs, railings and other locations subject to handling, or where surfaces will come into contact with other painted surfaces or belongings.
 2. Solventborne (for use only where allowed by current VOC regulations):
 - a. Provide where harder finish is required (such as "wet" areas) and odor will not create problems with occupants.
 - b. These products shall not be used where color retention is a concern. Verify with Architect.
 3. All materials used shall comply with applicable Federal and local air pollution regulations, lead content laws, and current VOC requirements. If products listed in Schedule of Paint Products located at the end of this Section are not in compliance with regulations, laws, or requirements, Contractor shall notify Architect and shall provide information regarding substitute products.
- C. Basic painting materials such as linseed oil, shellac, turpentine, thinners, driers, and other similar products, shall be of highest quality, pure, be compatible with other coating materials, made by reputable, of manufacturer's listed or listed in MPI manuals, and have identifying labels on containers. Paint materials shall be factory fresh.

- D. Alternate materials submitted for prior approval shall have qualities and materials equal to the other listed manufacturer's scheduled, top of the line, first quality products. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.
- E. Standard Gloss Range: Provide paints in accordance with the following MPI standard ranges as measured in accordance with ASTM D523, and as indicated on the drawings:
- | <u>MPI Gloss and Sheen Standards</u> | <u>Gloss @ 60°</u> | <u>Sheen @ 85°</u> |
|---|--------------------|--------------------|
| Gloss Level 1 – traditional matte finish – flat | max. 5 units, and | max. 10 units |
| Gloss Level 2 – high side sheen flat – 'velvet-like' finish | max. 10 units, and | 10-35 units |
| Gloss Level 3 – traditional 'eggshell-like' finish | 10-25 units, and | 10-35 units |
| Gloss Level 4 – 'satin-like' finish | 20-35 units, and | min. 35 units |
| Gloss Level 5 – traditional semi-gloss | 35-70 units | |
| Gloss Level 6 – traditional gloss | 70-85 units | |
| Gloss Level 7 – a high gloss | more than 85 units | |
- F. Paints shall be ready mixed except for field catalyzed coatings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Before beginning work of this Section, examine and test subsurfaces to be painted or coated for adhesion of painting and coating systems. Report in writing to Architect conditions that will adversely affect adhesion of painting and coating work. Do not apply painting and coating systems until such adverse conditions are corrected by party responsible for adverse conditions. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Report defects in substrates that become apparent after application of primer or first finish coat to Architect in writing and do not proceed with further work on defective substrate until such defects are corrected by party responsible for defect.

3.02 PROTECTION

- A. Before painting, remove hardware, accessories, electrical plates, lighting fixtures and similar items and protect.
1. Provide "Wet-Paint" signs and other barricades and protections as required to protect adjacent surfaces and work of other trades, whether being painted or not.
 2. Mask permanent labels.
 3. Provide, distribute, and maintain a sufficient supply of clean drop cloths and other protective coverings.
 4. Protect foliage and other exterior finished surfaces from contact with cleaning materials and thoroughly flush with water after contact.
 5. On completion of each space, replace above items.
 6. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.

3.03 SURFACE PREPARATION

- A. General: Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting/coating system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
1. Surfaces requiring painting or finishing shall be thoroughly dry and cured, free of dirt, dust, rust, stains, scale, mildew, wax, grease, oil, deteriorated substrates, bond-breakers, efflorescence and other foreign matter detrimental to the coating's adhesion and performance. Repair voids, cracks, nicks and other surface defects with appropriate patching material. Finish flush with surrounding surfaces and match adjacent finish texture.
 2. Spot prime marred or damaged shop coats on metal surfaces with appropriate metal primer.
 3. Determine moisture content of plaster, stucco, cementitious materials, wood and other moisture-holding materials by use of a reliable electronic moisture meter.
 4. Determine alkalinity of plaster, stucco and other cementitious materials by performing appropriate tests.
 5. Do not paint surfaces where moisture content or alkalinity exceeds that which is allowed by paint manufacturer.
 6. Do not perform exterior painting while surface is damp, unless recommended by Manufacturer, nor during rainy or frosty weather. Interior surfaces shall be dry before painting.
- B. Wood:
1. Sandpaper in direction of grain to smooth and even surface, leaving no sanding marks, and then dust off. After primer or stain coat has been applied, thoroughly fill nail holes, minor holes, cracks and other surface imperfections with putty tinted with primer or stain to match wood or stain color. Bring putty flush with adjoining surfaces. Sand woodwork between coats to a smooth surface. Cover knots and sap streaks with a thin coat of shellac, or seal with a suitable stain blocking sealer.
 2. Finish door edges after final fitting.
 3. Backpriming: Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoater paint.
- C. Steel and Iron:
1. Remove grease, oil, mill scale, rust and rust scale and touch-up chipped or abraded places on items that have been shop coated. Remove and reprime incompatible or damaged shop applied primers. Comply with the Steel Structures Painting Council's (SSPC) recommendations for cleaning of uncoated steel and iron surfaces.
 2. When area will be exposed to view, sandpaper the entire primed area smooth, feather the edge of surrounding undamaged prime coat and spot prime in a manner to eliminate evidence of repair.
- D. Galvanized Metal and Aluminum:
1. Thoroughly clean by wiping surfaces with a non-hydrocarbon solvent that will not leave an oily residue. Apply surface conditioner or vinyl-wash pretreatment as required for proper adhesion if required by paint manufacturer. Prime galvanized metal with galvanized iron primer as recommended by paint manufacturer. A test sample of the complete painting system should be applied and checked for adhesion before final painting begins.
 2. Clean visible portions of throats of galvanized steel ductwork with solvent; wipe dry with clean rags and paint flat black.

- E. Concrete:
 - 1. Except for steam cured products, cure cement type surfaces from 60 to 90 days in accordance with Paint Manufacturer's recommendations before painting.
 - 2. The method of surface preparation shall be at Contractor's discretion, provided the results are satisfactory to the Architect, and the method is in compliance with applicable codes and requirements.
 - 3. Repair surfaces to be painted prior to application of prime and finish coat(s). Apply a tinted primer to the substrate to help identify surface imperfections. After the primer has thoroughly dried, patch, fill and repair surface imperfections to match and flush-out with adjacent finish texture and profile.
 - 4. Before first paint coat is applied, spot prime nails and other exposed metal occurring in the surfaces with a rust inhibitive primer as recommended by paint manufacturer.

- F. Plaster and Gypsum Board Surfaces:
 - 1. Fill cracks, holes or imperfections with compatible patching material and smooth off to match adjoining surfaces. Before painting, surfaces shall be first tested for dryness with a moisture testing device.
 - 2. Apply no paint or sealer on gypsum board or plaster when the moisture content exceeds 8 percent. Test sufficient areas in each space and as often as necessary to determine if the surface has the proper moisture content for painting. If the moisture content is between 8 percent and 12 percent, prime with alkali resistant primer.
 - 3. If 8 percent or less, prime with specified primer. Remove the dry salt deposits from plaster surfaces by brushing with a stiff brush before painting.

3.04 WORKMANSHIP

- A. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer, but not less than as specified for each paint system.
- B. Apply each coat of paint evenly and comply with manufacturer's drying time before applying subsequent coats.
- C. Touch up suction spots after application of first finish coat.
- D. Finished work shall be uniform, match approved color, texture and coverage, and free from runs, sags, clogging or excessive flooding. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping. Where varnishes or enamel is used, lightly sand, dust and clean undercoats to obtain a smooth finish coat. Sand carefully between each coat with fine sandpaper as necessary to produce even, smooth surfaces and to provide proper adhesion of subsequent coats.
- E. Where clear finishes are required, ensure tinted fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.
- F. Where specific mil thicknesses are required, check thickness by the following methods:
 - 1. Over ferrous metal - Elecometer Film Gauge
 - 2. Other surfaces - Tooke Dry Mil Inspection Gauge
- G. Finished work shall be a 'Properly Painted Surface' as defined in this Section.

3.05 APPLICATION

- A. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color and to produce satisfactory finish results.
- B. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
- C. Priming will not be required on items delivered with prime or shop coats, unless otherwise specified, or if shop applied prime coat is not compatible with specified painting system. Touch up prime coats applied by others as required to ensure an even primed surface before applying finish coat.
- D. Block Fillers: Provide level of block fill as scheduled to conform with the following:
 - 1. Level 1 – Regular Fill: Minimum block fill, reduces irregularity in masonry profile. One coat, spray applied.
 - 2. Level 2 – Medium Full Fill: Masonry profile slightly reduced. One coat, spray applied and back-rolled.
 - 3. Level 3 – Full Fill: Minimum block fill required for semi-gloss and gloss finishes. Use where conformance with health regulations is required. Number of coats as required to conceal most of masonry texture, spray applied and back-rolled.
- E. Plumbing, Mechanical and Electrical:
 - 1. Exterior and interior exposed water, gas, waste piping, sprinkler piping, conduit, lighting and electrical panels, telephone terminal boxes, galvanized ducts and insulated ducts, shall be painted in areas other than mechanical rooms, unless otherwise scheduled.
 - 2. Paint exposed unfinished fixtures, metal ducts, switch boxes, control panels, devices, starters, junction boxes, vents, drains, and other similar items, as directed by Architect.
- E. Spray paint prime coated (not pre-finished) grilles and registers with enamel or lacquer to match walls and ceilings. Paint materials shall not sag, run or bind movable parts of grilles, registers, louvers, baffles and other similar items.
 - 1. Throats of ducts shall be given one coat of flat black paint, wherever visibility of the interior of the duct is allowed through registers or other similar items. At fiber lined duct, use black latex paint.
 - 2. Examine the Mechanical and Electrical Drawings and Specifications to determine the amount of exposed work to be painted.
- F. Paint exposed surfaces of every member, paint items inaccessible after installation before installation, if required to be painted. Paint all exposed surfaces of overhead roof or floor structures, including deck, except where specifically indicated not to be painted.
- G. Edges, tops, and bottoms of wood doors shall be sealed and finished with the same finish as the door faces, to meet door manufacturer's warranty requirements. Verify edge color with Architect as different colors may be selected for each face.
- H. Paint items fitted with finish hardware after hardware has been temporarily removed.
- I. Heating and other equipment on or adjacent to walls or surfaces scheduled for painting, shall be disconnected, using workmen skilled in appropriate trades and moved temporarily to permit painting of surface. Following completion of painting, replace and reconnect items.

- J. In multiple coat paint work, tint each succeeding coat with slightly lighter color, but approximating shade of final coat, to facilitate checking application of specified number of coats. Tint final coat to scheduled and approved color. Tint prime and undercoats to a color similar to finish coat. Each coat of material applied must be inspected and approved by the Architect before the application of the succeeding specified coat; otherwise no credit for the concealed coat will be given, and the Contractor shall assume the responsibility to recoat work in question. Contractor shall notify the Architect when each coat is completed.
- K. Brush, wipe or roll stain in 2 coat application. Avoid lap marks by maintaining "wet-edge" continually being merged with existing liquid coverage and stop only at natural edges, turns and breaking places.
- L. Do not paint over Underwriters' Laboratory labels, fusible links, exposed sprinkler heads and other similar items.
- M. Paint piping, electrical or other equipment, conduit, vents and other similar items, on roof or other exterior locations as directed by Architect.
- N. Finish closets with same color as adjoining rooms, unless otherwise specified. Finish other surfaces same as nearest or adjoining surfaces, unless otherwise shown or scheduled.
- O. Paint surface of walls which will be concealed by cabinets and other items mounted on or attached to walls.

3.06 ADJUSTING

- A. Correct deficiencies in workmanship required to leave surfaces in conformance with 'Properly Painted Surface' as defined in this Section.

3.07 CLEANING

- A. During the course of the Work and upon completion of work, remove misplaced paint and stain spots or spills from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition. Remove debris caused by work of this Section from premises. Leave Work in clean condition acceptable to Architect and Owner.
- B. Remove oily rags and waste daily, taking precaution to prevent fire.

3.08 SCHEDULES

- A. Color Schedule:
 - 1. Architect will provide a complete schedule of colors. Colors may be selected from various manufacturer's color palettes. Manufacturer supplying paint shall match these colors. Contractor shall prepare duplicate set of samples of treatments for major surfaces. If a specific surface or item receiving a paint finish does not have a specific color indicated or selected by the Architect, obtain clarification from the Architect. Do not assume the confirmation of the same color on the adjacent surfaces.
 - 2. Final coat of paint shall not be applied until colors have been approved by the Architect.
- B. Schedule of Finishes: Refer to the "Finish Schedule" on the Drawing for designated finishes of areas.

- C. Finishing of the following listed items and materials will not be required and shall be protected, except where explicitly specified otherwise:
 - 1. Stainless Steel, brass, bronze, copper, nickel, monel metal, chromium, anodized aluminum; specially finished articles such as porcelain enamel, plastic coated fabrics, and baked enamel, unless otherwise indicated.
 - 2. Finished products such as ceramic tile, stone tile, glass, resilient flooring, and similar items.
 - 3. Pre-finished products such as wood casework, elevator cabs, pre-finished (powder-coated) metals, and similar items.

3.09 EXTERIOR PAINT FINISHES

- A. This schedule uses the generic names listed in the Schedule of Paint Products.
- B. System 101 (Ferrous Metals): Apply to exposed steel such as metal doors and frames, grilles, light fixture standards in parking areas, metal handrails, sectional doors that are not otherwise pre-finished, and other exposed miscellaneous ferrous metals that are not pre-finished. Refer to High Performance Finish Systems Article 3.12 below for high performance paint finish applied to exterior decorative steel and wrought iron elements that are not otherwise prefinished.
 - 1. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
 - 2. 2nd Coat: Same material as 3rd coat in accordance with manufacturer's recommendations.
 - 3. 3rd Coat:
 - a. Flat: Paint - Waterborne (100% Acrylic) (if noted on Drawings). Sheen shall be 4 to 6% per a 85 degree gloss meter.
 - b. Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
 - c. Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
- C. System 102 (Galvanized Metals): Apply to exposed galvanized metal such as copings, louvers and metal flashings.
 - 1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer).
 - 2. 1st Coat: Galvanized Metal Primer.
 - 3. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
 - 4. 3rd Coat:
 - a. Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise.
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
 - c. Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
- D. System 103 (Aluminum): Apply to exterior louvers and other miscellaneous exposed exterior unfinished aluminum surfaces.
 - 1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
 - 2. 1st Coat: Aluminum Primer.
 - 3. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
 - 4. 3rd Coat:
 - a. Flat: Paint, Flat - Waterborne (100% Acrylic) (if noted on Drawings) Sheen shall be less than 10% per a 85 degree gloss meter.
 - b. Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).

- E. System 104 (Concrete Masonry Units): Apply to exterior concrete masonry unit construction indicated to be painted. (Refer to Section 07 19 00 “Water Repellents” for water repellent coating applied to exposed exterior integral colored decorative face CMU.) Roller apply 2nd or 3rd coat.
1. 1st Coat: Concrete Masonry Block Filler. Provide Level 2 or 3 Fill as required by gloss.
 2. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
 3. 3rd Coat:
 - a. Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
 - c. Gloss (if noted on Drawings): Enamel, Gloss – Waterborne (100% Acrylic - Non-Blocking).
- F. System 105 (Concrete and Stucco): Apply to exterior cementitious surfaces specifically indicated to be painted. Roller apply 2nd or 3rd coat.
1. 1st Coat: Concrete and Masonry Primer.
 2. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
 3. 3rd Coat:
 - a. Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
 - c. Gloss (if noted on Drawings): Enamel, Gloss – Waterborne (100% Acrylic - Non-Blocking).
- G. System 106 (Exterior Wood): Apply to wood fascias, outlookers, rafter tails, soffits, trim, and similar items where indicated to be painted.
1. 1st Coat: Exterior Wood Primer - Waterborne (100% Acrylic) unless noted otherwise.
 2. 2nd and 3rd Coats:
 - a. Flat - Rough-Sawn Wood: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 60 degree gloss meter.
 - b. Semi-Gloss - Smooth Surface Wood (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
 - c. Gloss - Smooth Surface Wood (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
- H. System 107 (Exterior Gypsum Board): Not Used.
- I. System 108 (Sealer - Masonry Parapet Top Surfaces): Not Used.

3.10 INTERIOR PAINT FINISHES

- A. This schedule uses the generic names listed in the Schedule of Paint Products.
- B. System 201 (Ferrous Metals): Apply to exposed metals such as steel doors, hollow metal frames, metal beam saddles, columns, grilles and registers, stair and hand railings, ladders, and other exposed miscellaneous metals.
 - 1. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
 - 2. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
 - 3. 3rd Coat:
 - a. Eggshell: Enamel, Eggshell.
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss.
 - c. Gloss (if noted on Drawings): Enamel Gloss.
- C. System 202 (Interior Wood Finishes - Enamel): Apply to wood doors indicated to be painted.
 - 1. 1st Coat: Enamel Undercoater.
 - 2. 2nd and 3rd Coat:
 - a. Eggshell: Enamel, Eggshell
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
 - c. Gloss (if noted on Drawings): Enamel, Gloss
- D. System 203 (Interior Wood Finish - Flat): Apply to plywood telephone backing boards and other miscellaneous softwood as noted, specified or scheduled.
 - 1. 1st Coat: Enamel Undercoater/Primer.
 - 2. 2nd and 3rd Coat: Flat Paint, - Waterborne (Vinyl Acrylic)
- E. System 204 (Galvanized Metals): Apply to exposed galvanized metal.
 - 1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer)
 - 2. 1st Coat: Galvanized Metal Primer
 - 3. 2nd and 3rd Coats:
 - a. Eggshell: Enamel, Eggshell
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
 - c. Gloss (if noted on Drawings): Enamel Gloss
- F. System 205 (Aluminum): Apply to interior louvers and other miscellaneous exposed unfinished aluminum surfaces.
 - 1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
 - 2. 1st Coat: Aluminum Primer
 - 3. 2nd and 3rd Coats:
 - a. Eggshell: Enamel, Eggshell
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
 - c. Gloss (if noted on Drawings): Enamel, Gloss
- G. System 206 (Gypsum Board, Plaster and Concrete - Wet Areas): Apply to gypsum board, plaster and concrete surfaces in toilet rooms, janitor rooms, kitchens, and other areas as scheduled.
 - 1. 1st Coat: Enamel Undercoater - Solventborne, unless noted otherwise.
 - 2. 2nd and 3rd Coats:
 - a. Eggshell (if noted on Drawings): Enamel, Eggshell - Solventborne.
 - b. Semi-Gloss: Enamel, Semi-Gloss - Solventborne or Enamel - Solventborne (Epoxy-Polyester).

- H. System 207 (Gypsum Board, Plaster and Concrete - Non-Wet Areas): Apply to gypsum board, plaster and concrete except for wet areas.
 - 1. 1st Coat: Waterborne Primer/Sealer. (Solventborne {Alkyd} shall be used at new untextured smooth gypsum board surfaces covered with powdery or unstable soft top joint cement)
 - 2. 2nd and 3rd Coat:
 - a. Eggshell: Enamel, Eggshell
 - b. Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
 - c. Flat (if noted on Drawings): Paint, Flat
- I. System 208 (Ferrous Metal - Chemical Resistant Finish): Not Used.
- J. System 209 (Interior Concrete Masonry - Wet Areas): Not Used.
- K. System 210 (Interior Concrete Masonry or Plaster - Extremely Wet Areas): Not Used.
- L. System 211 (Interior Concrete Masonry - Non-Wet Areas): Apply to exposed interior concrete masonry block units except areas specified above for enamel finish.
 - 1. 1st Coat: Block Filler, w/o Aggregate. Provide Level 1, 2 or 3 Fill as required by gloss.
 - 2. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
 - 3. 3rd Coat: Enamel, Semi-Gloss - Waterborne.

3.11 CLEAR WOOD FINISHES

- A. This schedule uses the generic names listed in the Schedule of Paint Products.
- B. System 301 (Stained and Clear Finish): Apply to wood doors, handrails and chair rails. Fill open grain hardwood such as Oak.
 - 1. Stained and Finished with Clear Satin or Gloss Varnish - Solventborne:
 - a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
 - b. 2nd Coat: Varnish, Gloss – Polyurethane (Solventborne)
 - c. 3rd Coat:
 - 1) Satin: Varnish, Satin – Polyurethane (Solventborne)
 - 2) Gloss: Varnish, Gloss – Polyurethane (Solventborne)
 - 2. Stained and Finished with Clear Satin or Gloss Varnish– Waterborne:
 - a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
 - b. 2nd Coat: Varnish, Gloss – Polyurethane (Waterborne)
 - c. 3rd Coat:
 - 1) Satin: Varnish, Satin – Polyurethane (Waterborne)
 - 2) Gloss: Varnish, Gloss – Polyurethane (Waterborne)

3.12 HIGH PERFORMANCE FINISH SYSTEMS

- A. General: Products included in the following high performance systems are not listed in the Schedule of Paint Products located at the end of this Section.
- B. System 401 (Exterior Steel) Apply to exterior decorative steel and wrought iron elements that are not otherwise prefinished.
 - 1. Clean steel to SSPC-SP6 (Commercial Blast Cleaning).
 - 2. 1st Coat: Tnemec Series 66 Hi-Build Epoxoline at 3 to 5 mils DFT, or Sherwin Williams Macropoxy 646 Fast Cure Epoxy, B58W610/B58V600, or International PC Interzinc 52 applied at 4 to 6 mils DFT, or PPG CORAFLOX ADS High Build Epoxy Primer/Intermediate KL ADS 538 at 2.5 to 6.0 mils DFT or PPG Pitt-Guard Rapid Coat D-T-R Epoxy Coating 95-245 Series applied at 5.0 to 7.0 DFT.

3. 2nd Coat: Sherwin Williams Fluorokem HS Fluoropolymer Urethane, B65-570/B65V580 applied at 3 to 4 mils DFT, or Tnemec Fluoronar Series 1070 Fluoropolymer Polyurethane or Interfine 979 at the following DFT mil thickness, or PPG CORAFLOX ADS High Build Epoxy Primer/Intermediate KL ADS 538 at 2.5 to 6.0 mils DFT or PPG Pitthane Ultra Gloss Urethane Enamel 95-812 Series at 2.0 to 3.0 mils DFT:
 - a. 1.5 mils at inaccessible locations that do not require abrasion resistance such as overhead canopies and building ornamentation.
 - b. 2.5 mils at locations that require abrasion resistance such as guardrails and railings and other items subject to human or mechanical contact.

3.13 SCHEDULE OF PAINT PRODUCTS

- A. Only those products which are specifically required by this Section shall be provided. Products listed in the following Schedule that are not specified in this Section are for information only.

(continued)

EXTERIOR PRIMERS/UNDERCOATERS	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Red Ferrous Metal Primer						
Waterborne	V110.20	BRPR00-1-RO	4020	90-708	B66N00310	18
Solventborne	M06-20	---	4160	7-858	B50NZ3	10-99
Galvanized Metal Primer						
Waterborne	M04	UGPR00-1	4020	90-712	B66W00310	18
Solventborne	---	GAPR00	4160	6-209	B50WZ0030	66
Vinyl Wash Pretreatment /Surface Conditioner						
Waterborne	---	ME01	88	---	B71Y1	---
Solventborne	V155	---	---	97-687	N/A	---
Aluminum Metal Primer						
Waterborne	P04	UGPR00-1	4020	90-712	B66W00310	18
Solventborne	V131.01	GAPR00	4160	6-204	B50WZ0030	66
White Ferrous Metal Primer						
Waterborne	M04-01	BRPR00-1-WH	4020	90-712	B66W00310	18
Solventborne	M07-01	---	4160	7-852	B50WZ004	10-99W
Concrete and Masonry Block Filler						
Waterborne (100% Acrylic)	958.11	SBPR00	4000	16-90	B42W00150	54-580
Waterborne (modified Copolymer)	---	SBSL00-1	GP3010	6-7, 6-15	B25W25	130
Solventborne	V163.90	---	---	95-217	B42W00400	54-660
					B42V00401	
Concrete and Masonry Primer						
Waterborne	068	ESPR00-1	GP3030	4-603, 4-100	LX02W0050	151
Solventborne	---	---	---	---	---	66
Waterborne Epoxy (2 component)	V163	SLPR00	2110N	98 Series	B73A00200	84
			Aquapon WB		B73V00200	
Masonry Surface Conditioner						
Waterborne	066	---	GP3030	4-808	LX03W0100	151
Solventborne	077	---	Amerlock Sealer	---	---	205
Exterior Gypsum Board Primer/Undercoater						
Waterborne	023	UGPR00-1	GP6001	6-609	B42W08041	6
Solventborne	024	---	GP2110	17-941NF	Y24W08020	36-603

(continued)

EXTERIOR PRIMERS/UNDERCOATERS (continued)	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Exterior Wood Primer						
Waterborne (100% acrylic)	023	EZPR00-1	GP6001	6-609	B42W08041	6
Solventborne	094	---	GP2110	17-941NF	Y24W08020	36-603
Multi-Purpose Primer						
Waterborne (100% acrylic)	023	UGPR00-1	GP3210	90 Series	B51W620	18
Solventborne	024	GAPR00	4160	97-689	---	37H
High Build Polyamide Epoxy Primer (2 Part)						
Waterborne	V440	---	4030	98 Series	B73A200/B73V200	462
Solventborne (ferrous metals)	V400	Carboguad 890	Ameriflock 2	97-DTR	B67A5/B67V5	66
Solventborne (galvanized metal)	V400	Carboguad 890	Ameriflock 2	97-DTR	B67A5/B67V5	66

EXTERIOR PAINT – FINISH COATS	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Paint, Flat (Gloss Rating 0-15 @ 85 degree gloss meter)						
Waterborne (Vinyl Acrylic or 100% Acrylic)	183	SSHV10	GP2250	10-Series	C01W00251	---
Waterborne (100% Acrylic)	N447	ACHS10 SSHL10	GP2200	6-610XI	A-100/A06W0151	115
Paint, Gloss Level 3 (Eggshell)						
Waterborne (100% Acrylic)	N185	EVSH30	GP2402	6-2045XI	A82W00151	--
Solventborne	P23	---	---	---	---	15
Enamel, Gloss Level 4 (Low Luster)						
Waterborne (100% Acrylic - Non-Blocking)	N448	EVSH40	GP2402	90-474	A82W00151	6
Solventborne	P23	---	---	---	---	--
Enamel, Gloss Level 5 (Semi-Gloss)						
Waterborne (100% Acrylic - Non-Blocking)	N449	EVSH50	GP2406	6-901XI	A76W00051	30
Solventborne	V201	9 Series	4328	---	B54WZ-400	23
Solventborne (Industrial)	V201	9 Series	4328	---	B54WZ-400	23
Solventborne (Acrylic Aliphatic Polyurethane - 2 Component)	V510	Carbothane 133HB	Am450H	95-8800 Series	B65-350/B60V30	73

(continued)

EXTERIOR PAINT – FINISH COATS (continued)	Benjamin Moore	Dunn-Edwards		Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Enamel, Gloss Level 6 (Gloss)							
Waterborne (100% Acrylic - Non-Blocking)	P28	EVSH60		GP3028	90-374/6-8534	A77W00051	---
Solventborne (Quick Dry)	V220	10 Series		4318	7-800/ 95-9000 Series	B54WZ-400	---
Solventborne (Silicone)	P21	42-53E		95-5000	95-5000	B56-300	---
Solventborne (Industrial)	P22	10 Series		4328	7-284	B54-150	2H
Solventborne (Aliphatic Polyurethane - 2 Component)	V500	---		Am450H	95-812 Series	B65-300/B60V30	1074
Solventborne (Acrylic Aliphatic Polyurethane - 2 Component)	V500	Carbothane 134 HG		---	---	B65W00721 B65V00720	1074
Elastomeric (Smooth)							
Waterborne (100% Acrylic)	055	Gardner Gibson Shur-Stik		GP2260	4-310 Matte	CF16-50 CF12-800	156
Textured Coating, Smooth							
Waterborne (Vinyl Acrylic)	3194.1	W320		GP2260	4-series	CF17W0801	180
Solventborne	---	---		---	---	---	---
Textured Coating, Medium							
Waterborne (Vinyl Acrylic)	3196.1	W322		GP3230	4-series	CF17W0811	181
Solventborne	---	---		---	---	---	---
Textured Coating, Coarse							
Waterborne (Vinyl Acrylic)	3192.1	W323		GP3230	4-series	CF17W0821	---
Floor Paint (Single or 2-component)							
Waterborne (Acrylic Epoxy)	V440	Sanitile 555		98 Series	98 Series	B90 Series	287
Solventborne	V400	Sanitile 945		GP3118	95-1	B62Z-100	280
Aluminum Paint							
Solventborne	P22-78	---		4309	6-230	B65S14 (moisture cure)	530
Aluminum Metal							
Waterborne	---	Rust-Oleum 5200 ALumi-Non		4020	90 Series	B71S00200	---
Solventborne	P22-78	---		---	---	B65S14 (moisture cure)	1077

EXTERIOR STAIN	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Solid Color Stain Waterborne (100% Acrylic)	089	ACH10/SSH1.10	Flood SWF	77 Series (Olympic)	A15W00051	617
Solventborne (Oil)	080	---	---	Olympic	---	607
Semi-Transparent Toner Waterborne (Water Repellent)	---	Okon Weather Pro	Flood CWF UV	77 Series (Olympic)	SD1	633
Solventborne (Oil)	328	Cabot	Flood CWF Oil	Olympic	SD2	660
Semi-Transparent Stain Waterborne (Water Repellent)	---	Okon Weather Pro	Flood CWF UV5	77 Series (Olympic)	SD3	633
Waterborne	---	---	Flood TWF Semi	77 Series	SD4	617
Solventborne (Oil)	328	Cabot	Flood CWF Oil	Olympic	A15T00005	607

EXTERIOR CLEAR FINISHES	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Spar Varnish, Gloss Waterborne	---	---	---	---	---	---
Solventborne	440	McClosky MC80-6509	1907	Olympic	Minwax Helmsman Spar Urethane	---
Aliphatic Polyurethane, Gloss (2 Part)	M74/M75	---	Am450H	95 Series	B65T105/B65V105/B65 C105 Diamond Clad Clear Coat	76
Solventborne	---	---	---	---	Minwax Helmsman	---
Exterior Gloss Varnish, Alkyd (Paleamber)	---	---	---	---	---	---

INTERIOR PRIMERS/UNDERCOATERS	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Red Ferrous Metal Primer	V110.20	BRPR00-1-R0	4020	90-708	B66N00310	18
Waterborne Solventborne	P06-20	---	4160	7-858	B50NZ3	10-99
White Ferrous Metal Primer	P04-01	BRPR00-1-WH	4020	90-712	B66W00310	18
Waterborne Solventborne	P06-01	43-5	4160	7-852	B50WZ4	10-99W
Galvanized Metal Primer	P04-01	UGPR00-1	4020	90-712	B66W00310	18
Waterborne Solventborne	---	GAPR00	4160	6-209	B50WZ0030	66
Aluminum Primer	P04	UGPR00-1	4020	90-712	B66W00310	18
Waterborne Solventborne	P06	GAPR00	4160	6-204	B50WZ0030	66
Primer/Sealer (for drywall, etc.)	253	VNSL00	GP1030	6-4	B28W08601	51-792
Waterborne (Vinyl Acrylic)	N534	VNSL00	GP9116	9-900	B28W02600	---
Waterborne (Zero VOC)	024	Cover Stain	GP1110	17-941NF	B79W8810	36-603
Solventborne (Alkyd)	253	VNSL00	GP1030	6-2	B28W08601	51-792
Vinyl Acrylic Wall Sealer	253	VNSL00	GP1030	17-921		
Waterborne	245	---	GP1120	17-941NF	B51W620	18
Enamel Undercoater/Primer	---	MBPR00	---	---	B79W8810	36-603
Waterborne (100% Acrylic)	---	---	---	---		
Solventborne	958.11	SBSL00-1	GP3010	6-7	B25W25	54-580
Block Filler, w/ Aggregate	958.11	SBPR00	4000	6-15, 16-90	B42W00150	130
Waterborne Waterborne (100% Acrylic)	V163	---	---	Amerlock	B42W400/B42V401	54-660
Solventborne (Polyamide-Epoxy)	---	---	Am400B	---	B70W100/B601V15	462
Epoxy Polyester Primer	---	---	F	---		
Waterborne Solventborne	V131	GAPR00	---	---	B67W00201	84

(continued)

INTERIOR PRIMERS/UNDERCOATERS (continued)	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Vinyl Wash Pretreatment/Surface Conditioner	---	ME01	88	---	B71Y1	---
Solventborne	V155		---	97-687/688	---	---
Concrete and Masonry Primer	068	ESPR00-1	GP3030	4-100, 4-603	LX02W0050	151
Waterborne	077	---	GP2110	---	---	84
Solventborne	V155	SLPR00	Am235	97 Series	B73A00200 B73V00200	54-660
Epoxy (Two Component)						

INTERIOR PAINT - FINISH COATS	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Acoustic Paint	258	W615	GP1210v	50 Series	Procoat ProCoustic Acoustical Tile and Ceiling Coating	180
Waterborne (Vinyl-Acrylic)						
Paint, Gloss Level 1 (Flat)	275	SWLL10	GP1210v	6-70	B30W04651	180
Waterborne (Vinyl Acrylic)	N534	SWLL10	GP1410	9-110	B30W02651	115
Waterborne (Low Odor/Low VOC)	N534	SZRO10	GP9110	9-110	B30W02651	---
Waterborne (Low Odor/Zero VOC)	306	---	GP1310	---	---	15
Solventborne						
Enamel, Gloss Level 2 (Low Sheen)	N537	SPMA30	GP1433v	---	---	6
Waterborne (100% Acrylic)	274	SWLL30	GP1412	6-510	B24W02651	---
Waterborne (Vinyl Acrylic)	N537	SZRO30	GP9100	9-510	B20W02651	---
Waterborne (Low Odor/Zero VOC)	P23	---	GP1502	7-824	---	15
Solventborne						
Enamel, Gloss Level 3 (Eggshell)						
Waterborne (100% Acrylic)	N538	SPMA40	GP1403	**6-411	B66-660	---
Waterborne (Vinyl-Acrylic)	274	SWLL40	GP1412	9-300XI	B20W4651	---
Waterborne (Low Odor/Zero VOC)	N538	---	GP9300	**6-411	B20W02651	---
Waterborne (Non-Blocking - 100% Acrylic)	N538	EVSH40	GP1403	---	B75W00051	---
Solventborne	P23	---	---	---	---	---

(*Not 100% Acrylic, but is their top of line product)
(continued)

INTERIOR PAINT – FINISH COATS (continued)	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Enamel, Gloss Level 5 (Semi-Gloss)						
Waterborne (100% Acrylic)	N539	SPMA50	GP1416	6-8510	B66-650	29
Waterborne (Non-Blocking - 100% Acrylic)	N539	EVSH50	GP1407	6-8510	A76W00051	---
Waterborne (Low Odor/Low VOC)	N539	SWLL50	GP1456	9-510	B31W04651	29
Waterborne (Low Odor/Zero VOC)	N539	SZRO50	GP9200	9-510	B31W02651	---
Waterborne (2 Component Epoxy)	V440	Sanitile 255	98 Series	98 Series	B70-200/B60V25	113
Solventborne	271	AWLL50	4309	---	B54Z	23
Solventborne (Industrial)	P24	9 Series	4309	7-844	B54Z	23
Solventborne (Epoxy-Polyester)	---	---	Am235	---	B58-600/B58V600	66
Enamel, Gloss Level 6 (Gloss)						
Waterborne (Non-Blocking - 100% Acrylic)	N540	EVSH60	GP3028	90-375	A77W00051	---
Waterborne (2 Component Epoxy)	V440	Sanitile 555	4408 Low-VOC	98 Series	B73W00300 B73V00300	114
Waterborne (Low Odor/Low VOC)	N540	---	GP3038	---	---	28
Solventborne	P22	10 Series	4309	7-800/ 95-9000 Series	B54-150	2H
Solventborne (Quick Dry)	V220	10 Series	4318	95- Series	B54Z	---
Solventborne (Industrial)	P22	10 Series	4328	7-812 Series	B54Z	2H
Solventborne (2-Component Epoxy)	V400	Carboguard 890	Amerlock 2	97 Series	B58-600/B58V600	135
Solventborne (Polyamide-Epoxy)	V400	Carboguard 890	Amerlock 2	97 Series	B58-600/B58V600	84
Floor Paint (Single or 2-component)						
Waterborne(Epoxy-Acrylic)	V440	Sanitile 555	---	98 Series	B-8100 Series	287
Solventborne	122	Sanitile 945	GP3118	7 Series	B62Z Series	280

INTERIOR STAIN	Benjamin Moore	Dunn-Edwards		Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Semi-Transparent Stain							
Waterborne (Water Repellent)	---	Okon Weather Pro		1700V	Olympic Premium Slr	---	633
Waterborne	---	Okon Weather Pro		1700V	Olympic Premium Slr	---	617
Solventborne (Wiping)	246	Old Masters or Valspar		1700	Olympic Premium	Minwax Performance Series	---
Solventborne (Oil)	234	Old Masters or Valspar		1700	---	---	607
Lacquer-Based Stain							
Waterborne	---	---		---	---	---	---
Solventborne	---	---		Gemini Lac Stain	---	---	---
Pigmented Solid Color Stain							
Waterborne (100% Acrylic)	089	ACHS10 SSHL10		---	Olympic	---	617
Solventborne (Oil)	080	---		---	---	---	607
Semi-Transparent Toner							
Waterborne (Water Repellent)	---	Okon Weather Pro		1700V	Olympic Premium	---	633
Solventborne (Oil)	---	---		1700	---	---	660

INTERIOR CLEAR FINISHES	Benjamin Moore	Dunn-Edwards		Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Resin Sealer							
Waterborne	---	---		1808	Olympic	---	462
Solventborne	---	---		1908	Olympic	---	203
Sanding Sealer							
Waterborne (Acrylic Urethane)	---	---		1916V	---	---	---
Solventborne (Brushing)	267	---		1916	Olympic	Minwax FD Sanding Sealer	---

(continued)

INTERIOR CLEAR FINISHES (continued)	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Varnish, Flat Solventborne	424	---	---	---	---	---
Varnish, Satin (Low Sheen)						
Waterborne (Acrylic Urethane)	423	Cabot 8082	1802	Olympic	Minwax OM Poly	---
Solventborne (Alkyd)	419	---	---	---	Minwax FD Varnish	---
Solventborne (Polyurethane)	435	Deftane Satin	1902	---	Minwax FD Poly	---
Varnish, Semi-Gloss						
Waterborne (Acrylic Urethane)	---	Cabot 8087	Aqua Zar	---	Minwax OM Poly	---
Waterborne (Acrylic)	---	---	---	---	Polycrylic S/G	---
Solventborne	---	---	---	---	---	---
Solventborne (Polyurethane)	---	Deftane Semi-Gloss	ZAR Poly	---	Minwax FD Poly	---
Varnish, Gloss						
Waterborne (Acrylic Urethane)	422	Cabot 8080	1808	Olympic	Minwax OM Poly	---
Solventborne	419	---	---	---	Minwax FD Varnish	---
Solventborne (Polyurethane)	428	Deftane Gloss	1908	---	Minwax FD Poly	---
Spar Varnish, Gloss Solventborne	440	McClosky MC80-6509	1907	Olympic	Minwax Helmsman	---
Paste Wax Solventborne	---	---	---	---	Minwax Pastewax	---
Lacquer Sanding Sealer Waterborne	---	Valspar Zenith PKS7200	Gemini TCHS	---	T65F520	---
Solventborne	---	Luster Lac 275 VOC-NAS 1420	Gemini SS	77 Line	---	---

INTERIOR CLEAR FINISHES (continued)	Benjamin Moore	Dunn-Edwards	Glidden Profess.	PPG Paints	Sherwin Williams	Tnemec
Lacquer, Flat Waterborne	---	Valspar Zenith 7001	---	---	T75F528	---
Solventborne	---	Valspar Luster Lac 275 VOC-NAF 1421	Gemini Gem-Lac	---	---	---
Lacquer, Semi-Gloss Waterborne	---	Valspar Zenith 7006	---	---	T75F526	---
Solventborne	---	Valspar Luster Lac 275 VOC-NAF 1426	Gemini Gem-Lac	77 Line	B44FJ86	---
Lacquer, Gloss Waterborne	---	Valspar Zenith LKC 7009	---	---	T75C525	---
Solventborne	---	Valspar Luster Lac 275 VOC-NAF 1429	Gemini Gem-Lac	---	B44CJ89	---
Lacquer, Crystal Clear Sanding Sealer Waterborne	---	---	---	---	T65F520	---
Solventborne	---	Valspar Luster Las 275 VOC-NAS 1420	Gemini Water Clr	---	---	---
Lacquer, Non-Yellowing, Flat Waterborne	---	Valspar Zenith LKF7001	---	---	T75F528	---
Solventborne	---	Valspar Luster Las 275 VOC-NAS 1420	Gemini Gem-Lac	---	---	---
Lacquer, Non-Yellowing, Semi-Gloss Waterborne	---	Valspar Zenith LKF7006	---	---	T75F526	---
Solventborne	---	Valspar Luster Las 275 VOC-NAF 1426	Gemini Gem-Lac	---	---	---
Lacquer, Non-Yellowing, Gloss Waterborne	---	Valspar Zenith LKF7006	---	---	T75C525	---
Solventborne	---	Valspar Luster Lac 275 VOC-NAF 1429	Gemini Gem-Lac	---	---	---

END OF SECTION

SECTION 10 11 00
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Shop Drawings: Submit brochures and Drawings of visual display boards showing method of construction and mounting techniques.
- B. Samples: Submit color samples of visual display board surfaces and trim for color selection from Manufacturer's full range of standard colors and patterns.
- C. Contract Closeout Submittals: Submit 2 copies of Manufacturer's printed maintenance instructions in accordance with Section 01 77 00.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.

1.03 WARRANTY

- A. Furnish Manufacturer's printed standard warranty for chalkboards.

PART 2 MATERIALS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 - 1. Allen Display www.allendisplay.com
 - 2. ADP/Lemco, Inc. www.adplemco.com
 - 3. Allied Building Products www.alliedbuildingsupplyinc.com
 - 4. MooreCo, Inc. www.moorecoinc.com
 - 5. Claridge Products & Equipment, Inc. www.claridgeproducts.com
 - 6. Ghent Manufacturing Inc. www.ghent.com
 - 7. Marsh Industries, Inc. www.marsh-ind.com
 - 8. Platinum Visual Systems; a division of ABC School Equipment, Inc. www.pvsusa.com

2.02 LIQUID MARKER BOARDS

- A. Core: 3/8 inch particle board.
- B. Backing: Aluminum foil.

- C. Enamel Finish: 24 gauge stretcher-level steel sheet manufactured in accordance with the performance specification for porcelain enamel steel chalkboards. Enamel finish shall be applied automatically to the steel, in a uniform thickness and fired under rigidly controlled temperatures to fuse the porcelain permanently to the steel. Finished surface shall be highly scratch and stain resistant.

2.03 TRIM

- A. Aluminum Trim:
 - 1. Style: Claridge Series 3 chalk trough, map rail at top of board with four 4 map clips per each 8'-0" section and side trim.
 - 2. Finish: Brushed aluminum, unless noted otherwise on Drawings.

2.03 FABRICATION

- A. Factory assemble visual display board and ship to the job, ready to fasten to wall, pressure laminated to backing and framed on each side with extrusions as shown on review shop drawings and as specified.
- B. Aluminum extrusions: Cut to exact length and accurately. At corners, except at chalk trough, reinforcing angles shall be used.
- C. Size(s): As indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work shall be construed as acceptance of subsurfaces.
- B. Verify that grounds and solid blocking necessary for proper installation of chalkboard panels has been installed. Stud walls shall have solid blocking for attachments of chalkboards and tackboards.

3.02 INSTALLATION

- A. Visual Display Boards: Install at locations shown on Drawings in accordance with Manufacturer's printed Specifications, except as otherwise detailed.
 - 1. Install plumb, level and true to line, securely attached to grounds, blocking and supports.

3.03 CLEANING

- A. Upon completion of installation, clean chalkboards and leave in ready-to-use condition.
- B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Interior room and code required identification signage.
 - 2. "No Smoking," "Smoke Free...", and similar signage.
 - 3. Exterior formed metal building address signage.
 - 4. Reflective tape for pipe bollards.
- B. Related Sections:
 - 1. Section 10 14 53 – Traffic Control Signs, for exterior parking lot and drive traffic control signage.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's brochures indicating materials and finishes.
- B. Shop Drawings: Show sizes of members, method of construction, copy layout, and mounting details for proper mounting for interior and exterior signage and door identification signage. Furnish template for mounting metal letters.
- C. Samples: Submit sample letters, panels, and completed signs, fonts and proposed anchorages.

1.03 QUALITY ASSURANCE

- A. Verify addressing requirements, including sizes and locations with governing authority prior to fabricating exterior signage.
- B. Regulatory Requirements: Comply with the following:
 - 1. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act (AzDA) (ARS Section 41-1492.03).

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage and Protection: Store items in dry, protected areas. Adequately protect against damage while stored at the site. Keep free of corrosion or other damage.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. Interior Room, Non Smoking, and Similar Code Required ID Signage:
 - a. ASI-Modulex www.asimodulex.com
 - b. Best Manufacturing Company www.bestsigns.com
 - c. Epic Sign Group www.epicsigngroup.com
 - d. Mountain States Specialties
 - e. Signsource www.signsource.com
 - f. Skyline Signs Inc. www.skylinesigns.net
 - g. Vomar Products, Inc. www.vomarproducts.com
 - h. Other regional source as approved by Architect.
 2. Metal Signage:
 - a. ASI-Modulex www.asimodulex.com
 - b. ARK Ramos Manufacturing Co., Inc. www.arkramos.com
 - c. Matthews. www.matthewsbronze.com
 - d. Southwell. www.southwellco.com
 - e. Spanjer Brothers, Inc.
 - f. Metallic Arts. www.metallicarts.com
 - g. Other regional source as approved by Architect.

2.02 MATERIALS

- A. Materials shall be new stock, free from defects, imperfections strength, durability, and appearance. Types of materials and colors shall be selected by Architect based on final signage design.
- B. Metals - General:
1. For fabrication of exposed metal work, use only materials which are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks, and trade names.
 2. Do not use materials which have stains and discolorations.
 3. For exposed items of work which include plain flat surfaces in width of more than 50 times the metal thickness, provide sheet stock from mill which has been stretcher leveled to highest standard of flatness commercially available.
 4. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.
 5. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.
- C. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
1. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, for background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended. Color(s) as selected by Architect.
 2. Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.

3. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected by Architect from the manufacturer's standards.
- D. Extruded Aluminum Sign Frames: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 6063-T5.
- E. Melamine plastic laminate, 1/8 inch thick, rated non-static, fire retardant and self extinguishing.
- F. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- G. Adhesive: Liquid silicone adhesive or other adhesive recommended by the sign manufacturer for type of mounting indicated.
- H. Tape: VHB (very high bond) double-stick foam tape as manufactured by 3M.
- I. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- J. Reflective Tape for Pipe Bollards: Pressure—sensitive, self-adhesive, reflective engineers tape as indicated on Drawings as manufactured by 3M or equivalent as approved by Architect.

2.03 METAL SIGNAGE

- A. Metal Letters:
 1. Material: Fabricate individual metal letters from sheet metal of gauge recommended by manufacturer for size of characters, but not less than 22 gauge.
 2. Characters/Font: Size and font style as indicated on Drawings or as selected by Architect to match existing.
 3. Fabrication: Reverse pan design, 12 inches high, with depth and spacing to match existing adjacent buildings as approved by Architect.
 - a. Continuously solder or weld all seams to prevent water intrusion. Provide screened weep hole on back bottom of each individual character.
 4. Finish: Fluoropolymer factory applied finish containing a minimum of 70 percent Penawalt Kynar 500 resin and meeting AAMA's 605.2 high performance specifications. Apply 3 coats including primer coat, color coat, and clear top coat.
 - a. Color: As selected by Architect.
 5. Mounting: Threaded studs set in adhesive, flush mounted or projected with spacers, as indicated.

2.04 ROOM AND IDENTIFICATION SIGNAGE

- A. Fabricate signage from acrylic sheet with aluminum frame as detailed on Drawings. And as follows:
 1. All signage shall comply with applicable ADA requirements.
 2. Sign Base Sheet Thickness: 1/8 inch thick minimum.
 3. Colors: As selected by Architect and in accordance with local and Federal requirements

4. Aluminum Frames: Fabricate sign mounting frames from aluminum formed to frame profile indicated with slots or stops to accept acrylic sheet sign panel as detailed. Provide means to lock sign panels in place after being inserted into sign frame.
 5. Mounting: Fabricate units for fastening with screws, double-stick tape or adhesive mount as indicated on Drawings or as approved by Architect.
 6. Finish and contrast:
 - a. Frame Finish: As scheduled on Drawings or as selected by Architect.
 - b. Sign Characters: Characters shall contrast with eggshell matte background by at least 20 percent.
 7. Letters and Braille characters:
 - a. Raised 1/32 inch upper case, sans serif or simple serif, and accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch high, but not higher than 2 inches.
 - b. Letters and numbers: Width-to-height ratio from 3:5 to 1:1, and stroke width-to-height ratio from 1:5 to 1:10.
 - c. Text: Required quantity of each sign shall be as directed by Architect.
- B. Self Adhesive Vinyl: Self-adhesive vinyl letters and numbers as indicated on Drawings. Font type and size as indicated on Drawings or as selected by Architect.
1. Color: As indicated on Drawings or as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Construction Manager. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. General: Locate sign units where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
- B. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.
- C. Install plumb and level in accordance with Manufacturer's instructions.
- D. Securely fasten wall mounted items to solid backing.
- E. Do not field cut any signage members.
- F. Clean and polish exposed surfaces.
- G. Self-Adhesive Vinyl Letters: Clean glass as recommended by manufacturer and apply letters level and at proper spacing at locations indicated.

- H. Wall Mounted Panel Signs: Fasten units to achieve secure attachment by fastening with concealed tamper-resistant headed screws, double-stick tape or adhesive mount as indicated on Drawings or as approved by Architect.
 - 1. Height shall be 60 inches above finish floor to centerline of sign at wall mounted signs, unless otherwise indicated on Drawings.
 - 2. When screw fastening, provide a minimum of 2 screws per sign, or as otherwise indicated on Drawings.
 - 3. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
 - 4. Double-Stick Tape Mounting: Clean surfaces to be joined and apply double stick tape to back of wall mounted signage in continuous strips at approximate 2 inch center to center spacing between strips. Apply sign to wall surface taking care to properly align and plumb signage before removing release paper.
- I. Reflective Tape for Pipe Bollards: Install pressure—sensitive, self-adhesive, reflective engineers tape on pipe bollards as indicated on Drawings after finish painting is complete.
- J. All exterior wall penetrations shown on Drawings or otherwise required for signage installation shall be located by using full-size installation templates furnished by the signage fabricator.
- K. Seal, patch and paint all penetrations.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 14 53
TRAFFIC CONTROL SIGNS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes traffic control signs and supports.

1.02 SUBMITTALS

- A. Submit product data, shop drawings and samples.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Metals: New stock, free from defects impairing strength, durability or appearance.
 - 1. Steel Shapes, Plates, Rod, Bars and Bar-size Shapes: ASTM A36.
 - 2. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.
 - 3. Steel Tubing: ASTM A500.
 - 4. Aluminum Sheet: ASTM B209 having strength and durability meeting 5005-H15, .080 inch minimum thickness.
- B. Signage Supports: Provide galvanized steel pipe, tube or u-channel sign support posts as detailed on Drawings, complying with city/town standards. Provide welded steel caps at all hollow pipe or tube supports. Paint with thermoset acrylic polyurethane enamel or polyester powder coated finish in color indicated on Drawings or as selected by Architect.
 - 1. U-Channel Sign Posts: As manufactured by Zumar Industries, Inc., or equivalent www.zumartraffic.com.
- C. Plastics: New stock, free from defects and of the best quality available.
- D. Paints: Type made for the surface material on which it is to be applied and recommended by the manufacturer of the paint. No paint that will fade, discolor or delaminate as a result of proximity to UV light sources or heat therefrom shall be used.
- E. Sign hardware and Accessories: As manufactured by Zumar Industries, Inc. or equivalent www.zumartraffic.com .

2.02 FABRICATION

- A. Fabricate in accordance with the City of Buckeye and MAG Standard Details, and as indicated on Drawings.
- B. Shop/Factory/Finishing:
 - 1. Paint shall be thoroughly and evenly applied and shall be well worked into corners and joints and shall not have edge or joint buildups.
 - 2. Paint shall be evenly applied and without pinholes, scratches, orange peeling, application marks, etc.
 - 3. Workmanship in connection with finishes shall conform to the standard of the trade. Prime coats or other surface pre-treatments, where recommended by the manufacturer for paints, shall be included in the work.

PART 3 EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION

- A. Install items square, plumb, true and accurately fitted. Leveling is to be done only by instruments.
- B. Embed signage support pipes in concrete filled holes as detailed.

3.02 CLEANING

- A. After installation, surfaces marred during erection, and exposed bolts, bolt heads, etc., shall be retouched with the same paint used previously.

END OF SECTION

SECTION 10 21 16.56
PRECAST SHOWER BASES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Prefabricated precast terrazzo shower bases as shown on Drawings and as specified herein.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, design data and installation instructions.
- B. Shop Drawings: Submit drawings showing layout, dimensions and construction details. Show details of installation and connection to plumbing.
- C. Samples: Submit samples showing finish, including colors and textures.
- D. Certificates: Submit manufacturer certification that products furnished meet specification requirements.

1.03 QUALITY ASSURANCE

- A. Qualifications: Manufacturer shall be regularly engaged in the manufacture of standard units of the type specified.
- B. Regulatory Requirements: Comply with the following:
 - 1. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act (AzDA) (ARS Section 41-1492.03).

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following manufacturers, subject to compliance with specifications requirements:
 - 1. Acorn Engineering Company www.acorneng.com
 - 2. Florestone Products Co., Inc. www.florestone.com
 - 3. As approved by Architect.

2.02 SHOWER BASES

- A. Precast polished terrazzo receptor manufactured of marble chips cast in white Portland cement to produce a compressive strength of not less than 3,000 psi. Ground smooth and sealed. No air holes or bubbles allowed in finished surface. Coved corners and pitched to the drain outlet for positive drainage. Integral drain body of brass with removable stainless steel strainer for inside caulked connection to 2 inch drain pipe. 3 inch integral threshold on one side. Non-threshold sides shall have galvanized tiling flanges which extend 1-1/2 inch above the 1-1/4 inch wide shoulder.
 - 1. Color: As scheduled on Drawings, or as selected by Architect from manufacturer's full range of colors/patterns.
 - 2. Size: As indicated on Drawings.
 - 3. Bedding Compound: As recommended by Manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces. Verify that backup framing is correctly positioned to receive units.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's directions. Set accurately in position.
- B. Verify drain placement by positioning the base in the opening and install drain fitting in accordance with fitting manufacturer's directions.
- C. Set shower base in place with front lip resting tight to the floor. Provide bedding compound in accordance with manufacturer's directions, set in position and secure in place. Allow no traffic on bottom until the bedding compound has set.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 26 00

WALL PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Stainless steel corner guards.
 - 2. Stainless steel wall cladding.

1.02 QUALITY ASSURANCE

- A. Subcontractor qualifications: Fabricate and install the work of this Section using a subcontractor having a minimum of 5 years experience and trained in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance and desired aesthetic affect of the work of this Section.
- B. Reference standards: Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following.
 - 1. NAAMM Metal Finishes Manual.
 - 2. AWS Structural Welding Code.
 - 3. SMACNA Architectural Sheet Metal Manual.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, design data and installation instructions.
- B. Shop Drawings: Submit shop drawings showing sizes and fastening methods.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.
- B. Storage and Protection: Adequately protect against damage while stored at the site.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements.
- B. Temperature at the time of installation must be between 65-75 degrees F and be maintained for at least 48 hours after the installation to allow for proper adhesive set up.
- C. Relative humidity shall not exceed 80 percent.
- D. Do not expose wall panels to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Stainless Steel Corner Guards: Furnish products of the following manufacturer, except as otherwise approved by the Architect, subject to compliance with specifications requirements:
1. Acrovyn; Construction Specialties, Inc. www.c-sgroup.com
 2. Stainless Architectural Supply www.sasmfg.com
 3. As approved otherwise by Architect.

2.02 COMPONENTS

- A. Surface Mounted Stainless Steel Corner Guards:
1. 14 gauge Type 304 stainless steel with No. 4 satin finish.
 2. Size: 1-1/2 inches by 1-1/2 inches, unless otherwise indicated on Drawings.
 3. Corner: Square or rounded corner as indicated on Drawings, or as selected by Architect.
 4. Height: 48 inches, or as otherwise indicated on Drawings.
 5. Hardware: Provide attachment hardware for complete and secure assembly.
- B. Stainless Steel Sheet: ASTM A167 and unless indicated otherwise on Drawings, required by design, or directed by Architect, provide Type 304.
1. Finish: No. 4 Brushed, or as scheduled otherwise on Interior Drawings and Specifications.
- C. Adhesives, Anchors and Joint Sealers:
1. Joint Sealant: As specified in Section 07 92 00.
 2. Screws: Stainless steel, flat head countersink screws of sufficient length to penetrate wall studs.
 3. Adhesives: 3M fastbond 30, or as otherwise recommended by the decorative metal fabricator.
 4. Double-Sided Tape: 3M VHB double-sided, very high bond adhesive tape of type and width to suite application.

2.03 FABRICATION

- A. General:
1. Form and fabricate the Work to meet installation conditions.
 2. Include accessories to adequately secure the Work in place.
 3. Make provisions to connect with or to receive abutting construction.
- B. Field measurements: Verify dimensions before proceeding with shop fabrication of panels. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for the accuracy of such measurements and precise fitting and assembly of finished work.
- C. Fabricate stainless steel wall cladding from minimum 24-gauge stainless steel sheet to conform to Drawings and approved Shop Drawings. Hem all edges. Fabricate cladding with flat-lock seams, unless otherwise indicated on Drawings. Coordinate fabrication with adjacent and abutting finishes and equipment, cabinets, and other items indicated on Drawings.
1. Form wall cladding without warp or oil canning of surface finish. Provide heavier gauge where necessary to eliminate warp and oil canning.

- D. Coordinate fabrication with electrical, mechanical and plumbing components, fixtures and equipment.
- E. Fabricate cladding for adhesive or screw attachment to wall as indicated on Drawings.
- F. Where screws are used to attach stainless steel corner guards, pre-drill and countersink to accept flathead countersunk screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 2. Verify that prepared bases are in correct position and properly sized.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Surface Preparation: Surfaces to receive stainless steel corner and wall end guards shall be cleaned to remove all dust, debris, and other contaminants that would interfere with adhesive bond.
- B. Place corner guards in locations/rooms where units will be installed and acclimate to building conditions as specified herein in Project/Site Conditions article for a minimum period of 24 hours prior to installation.

3.03 INSTALLATION

- A. Install components in accordance with manufacturer's printed instructions and details on Drawings.
- B. Wall Cladding:
 - 1. Form, cut, drill, and fit stainless steel wall cladding as required for installation. Do not cut or abrade finishes that cannot be restored in the field.
 - 2. Install items accurately placed in location, plumb, level and in alignment and elevation with adjoining work. Fit field connections accurately together to form hairline joints.
 - 3. Attachment: Stainless steel sheet to supporting wall construction with adhesive. Double-sided VHB tape, and/or concealed fasteners to the greatest extent possible. Where exposed fasteners are unavoidable in the finished work, or indicated on Drawings as fastening method, provide Phillips round or low-profile head machine screws, except where decorative fasteners are indicated as part of the finished work. Evenly space and pre-drill holes for fasteners.

- C. Corners Guards:
 - 1. Install straight, true and to heights as indicated.
 - 2. Install stainless steel corner guards with adhesive or double-sided VHB tape as preferred method of attachment. Where necessary to provide secure attachment or where higher abuse is anticipated, install with countersunk #10 stainless steel screws in pre-drilled holes as standard with manufacturer, spaced at not more than 24 inches center to center.

3.04 ERECTION TOLERANCES

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

3.05 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 28 13

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes toilet accessory items as specified and as indicated on Drawings.
- B. Related Sections:
 - 1. Section 08 83 00 – Mirrors, for wall mounted mirrors.

1.02 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the following:
 - 1. ICC/ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act (AzDA) (ARS Section 41-1492.03).

1.03 SUBMITTALS

- A. Product Data: Submit Drawings and brochures of toilet accessory items showing sizes, construction and mounting techniques, and installation locations (Plans and Elevations).

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at site.
- C. Handling: Comply with Manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. To establish function, capacity and quality, toilet accessories scheduled on Drawings are based on products of Bobrick Washroom Equipment Co., Inc (Bobrick). Comparable toilet accessory products by one of the following Manufacturers may be provided, as approved by the Architect, subject to compliance with Specification requirements.
 - 1. ASI www.americanspecialties.com
 - 2. Bobrick Washroom Equipment Co., Inc. www.bobrick.com
 - 3. Bradley Corporation www.bradleycorp.com
 - 4. GAMCO a division of Bobrick www.gamcousa.com

2.02 MATERIALS

- A. Stainless Steel: AISI, Type 302/304, with satin No. 4 finish. Unless specified or indicated, the use of other stainless steel alloys shall not be allowed.
- B. Sheet Steel: Cold rolled, commercial quality, ASTM A1008. Surface preparation and metal pretreatment as required for applied finish.
- C. Chromium Plating: Nickel and chromium electro-deposited on metal, ASTM B456, Type SC 2.
- D. Mirror Glass: FS DD-G-451, Type I, Class 1, Quality 1, 1/4 inch thick, with silver coating, copper protective coating, and non-metallic paint covering.
- E. Galvanized Steel Mounting Devices: ASTM A123, hot-dip galvanized after fabrication.
- F. Locks: Tumbler type, keyed alike unless specified otherwise.
- G. Fasteners: Theft-proof screws. Use no adhesive mountings.
- H. Backing Plates: 16-gauge cold-rolled steel for mounting grab bars in stud partitions.
- I. Perimeter Sealant: Type "E" clear mildew resistant silicone sealant as specified in Section 07 92 00.

2.03 TOILET AND BATH ACCESSORIES

- A. Toilet and Bath Accessories, Shower Accessories, Rob Hooks, and Mop and Broom Holder:
 - 1. Grab Bars: Bobrick B-6806 series, stainless steel, 1-1/2 inches diameter, concealed mounting with snap-flange covers, satin finish, in sizes and locations as shown on Drawings. Grab bars shall support at least 900 pounds. Furnish with concealed anchors and anchor plates suited to grab bar location.
 - 2. Mirrors: Bobrick B-290 with stainless steel frame, size as shown on Drawings.
 - 3. Shelf with Mop and Broom Holders: Bobrick B-224 x 36 inches, or width as otherwise shown on Drawings.
 - 4. Paper Towel Dispensers: As scheduled on Drawings.
 - 5. Toilet Paper Dispensers: As scheduled on Drawings.
 - 6. Rob Hooks: As scheduled on Drawings.
 - 7. Shower Rods and Curtains: As scheduled on Drawings.
 - 8. Folding Shower Seats: As scheduled on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination with other Work: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install items in accordance with Manufacturer's published instructions and approved installation drawings in locations as shown on Drawings, and in compliance with ANSI A117.1 as applicable.
- B. Secure toilet room accessories to adjacent walls and partitions in accordance with the Manufacturer's instructions for each item and each type of substrate construction and as follows:
 - 1. Attachment to Toilet Partitions: Secure at screw attachment point with sheet metal screws furnished by Manufacturer or by 3/16 inch diameter through-bolts.
 - 2. Attachments of Recessed Accessories: Place shims between framing and cabinet at screw attachment points.
 - 3. Attachment of Surface Mounted Accessories: At metal stud walls, provide concealed sheet metal backing plate as indicated on Drawings to allow attachments with No. 18 x 1-1/2 inch sheet metal screws. At solid walls, rawl plugs, expansion shields or toggle bolts shall be provided. Mirrors shall be locked to wall hangers by tightening locking screws concealed in lower frame. Soap dispensers shall be mounted with 4 inch clearance from filler top to underside of any horizontal projection.
- C. Grab Bars:
 - 1. Framed wall construction: Install concealed anchor plates to studs. Attachment to studs must be sufficient to withstand a downward load of at least 300 pounds, when tested according to ASTM F446. Accurately position and fasten before wall finish is applied. After wall surface is finished, secure concealed mounting plate to anchor plate using stainless steel machine screws furnished by the Manufacturer.
 - 2. Toilet Compartments: Through-bolted connection to anchors.
- D. Seal wall penetrations with sealant as specified in Section 07 92 00 to prevent moisture penetration through joints around fixtures.

3.03 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings just prior to Substantial Completion of Project.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.
- D. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 28 19

GLASS SHOWER ENCLOSURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Glass shower enclosures and doors with frames and hardware as shown on Drawings and as specified herein.

1.02 ASSEMBLY DESCRIPTION

- A. Framed shower enclosure assembly includes all glazing, support framing, gasketing, fixed and operable hardware for complete and watertight shower enclosure.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide glazing systems capable of withstanding normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lights for size openings indicated in nominal thicknesses indicated, but not less than thicknesses and in strengths required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM C1036 and ASTM C1048-85, fully tempered, complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, construction details, material descriptions, dimensions of individual components and profiles, finishes for connection and operable hardware and pulls, rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Shop Drawings: Show fabrication and installation details for each configuration of shower enclosure indicated.
- C. Samples for Initial Selection: For each type of glazing and hardware of metal finish indicated.
- D. Samples for Verification: For each type of glazing and hardware component indicated.
- E. Qualification Data: For Installer.
- F. Material Test Reports: For each type of glazing.
- G. Maintenance Data: For hardware finishes to include in maintenance manuals.
- H. Warrant: Special manufacturers specified in this Section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations: Obtain shower enclosure components through one source from a single manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Handling: Comply with manufacturer's instructions.
- C. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- D. Deliver glass to site with manufacturer's labels showing thickness, quality and type, floor location, and/or other denotations which identify where glass is to be used.
- E. Deliver glazing compound and other glazing items to site in manufacturer's original unopened packages or containers.
- F. Store glass in dry, well-vented location at a temperature maintained above dew point. Minimize the handling of glass and protect from soiling, atmospheric condensation and other moisture.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify shower enclosure openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.08 WARRANTY

- A. Special Warranty: Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of shower enclosure that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracked, bowed, fissured, or glazing that contains visible imperfections.
 - b. Faulty operation of operable hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one the following manufacturer, except as approved by the Architect, subject to compliance with specifications requirements:
1. Arizona Shower Door www.arizonashowerdoor.com
 2. American Shower Door www.americanshowerdoor.com.
 3. C.R. Lawrence www.crlaurence.com
 4. PRL Glass Systems, Inc. www.prlglass.com

2.02 MATERIALS

- A. Glass: Provide flat, fully tempered glass in thickness indicated. Comply with requirements of ASTM C1048 for kind FT (fully tempered), and the following:
1. Thickness: 3/8 inch minimum.
 2. Glass Type: Obscure glass as selected by Architect.
 3. Edge Treatment: Machine grind and polish all exposed edges.
 4. Dimension Tolerances of Glass Units: Conform to ASTM C1036-85 and ASTM C1048-85.
- B. Frames and Hardware: Provide manufacturer's standard frame and hardware of types and finish indicated on Drawings or as selected by Architect.
1. Aluminum Door Frames, Tracks and Hardware: 6063-T5 aluminum extrusions of alloy and temper as required by manufacturer.
 2. Sweeps: Provide clear rubber sweep on bottom of doors.
 3. Hinges: Solid brass construction with stainless steel pins and springs. Provide complete with gaskets, screws and mounting template, finish as indicated below.
 4. Door Handles and Towel Bars: Type and design as indicated on Drawings or as selected by Architect.
 5. Plastic Washers: As standard with Manufacturer.
 6. Decorative Metal Washers: 1-1/4 inch diameter metal washer.
- C. Sealant: Type "E" clear mildew resistant silicone sealant as specified in Section 07 92 00.
- D. Miscellaneous: Provide standard resilient stops, magnetic catches, trim and other items as necessary for a complete, watertight installation.
- E. Anchors and Fastenings: Manufacturer's standard stainless steel concealed anchors and fastenings. Where exposed in the finish Work, provide fasteners matching finish of units being installed. Fasteners shall comply with International Fasteners Institute Standard B1.6.3 for Slotted and Recessed Head Machine Screws and B18.6.4 for Slotted and Recessed Head Tapping Screws and Metallic Drive Screws.

2.03 FABRICATION

- A. Field measure each shower enclosure prior to fabrication and identify by room / location.
- B. General: Fabricate glass panels to sizes and configurations indicated. Sizes of doors are indicated on the drawings. Complete fabrication, test-assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components as necessary for shipment and installation.
1. Locate and provide holes and cutouts in glass to receive hardware before tempering glass. Do not permit cutting, drilling or other alterations to glass after tempering.
 2. Fabricate work to accommodate required fittings and hardware.

- C. Finishes: Satin nickel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install shower enclosures and associated components in accordance with manufacturer's printed instructions and recommendations.
 - 1. Set units level, plumb, and true to line.
 - 2. Lubricate and adjust hardware and other moving parts for proper function.
- B. Perimeter Sealant Application: Apply continuous bead of silicone sealant between fixed frames and wall finish, or as otherwise indicated on Drawings. Do not apply sealant over frame weep holes.

3.03 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.02 SUMMARY

- A. Section includes the following:
 - 1. Fire extinguishers.
 - 2. Cabinets for fire extinguishers.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's data and installation instructions for each item, including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire Extinguisher Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Verification: For each type of exposed factory-applied color finish required for cabinets, prepare 6-inch x 6-inch square Samples.

1.03 QUALITY ASSURANCE

- A. Standards: Comply with ANSI/UL 92 and 711.
- B. Regulatory Requirements: Conform to ANSI/NFPA 10 and the following:
 - 1. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA)."
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act of 1992 Administrative Rules (AzDAAG).
 - 5. Fire extinguishers shall be listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 6. Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
 - 7. Provide fire extinguishers approved, listed, and labeled by FMG.

1.04 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable 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.
 - c. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. Amerex (Fire Extinguishers only) www.amerex-fire.com
 2. Larsen's Manufacturing Company www.larsensmfg.com
 3. J.L. Industries www.jlindustries.com
 4. Potter Roemer Fire Protection Equipment www.potterroemer.com

2.02 EQUIPMENT

- A. Multi-Purpose Dry Chemical Extinguisher:
1. Capacity and UL Rating: 10 lbs., 4A-60B:C, or as otherwise required by Fire Official.
 2. Rechargeable type.
 3. Tank: DOT approved steel cylinder.
 4. Metal head, handles, valves and siphon tube. Plastic handles, valve assemblies and siphon tubes are not allowed.
 5. Replaceable molded valve stem seal.
 6. Pressure gauge.
- B. Fire Extinguisher Cabinet:
1. Model 2409 Series as manufactured by Larsen's is acceptable.
 2. Trim Style and Projection: Semi-recessed, 1-1/2 inch rolled edge, and surface mounted. Refer to Drawings for locations.
 3. Inside box dimensions: Manufacturer's standard for size of extinguisher specified.
 4. Door:
 - a. Full glass with Larsen-Loc, or as otherwise indicated on Drawings.
 - b. Trim and Door (Steel): One piece, constructed of cold-rolled steel with Manufacturer's standard baked enamel or powder coated finish in standard color as selected by Architect.
 - c. Door Glazing: Plastic, clear, 1/8 inch thick acrylic.
 5. Recessed Box: Heavy gauge, black baked acrylic enamel box
 6. Cabinet Signage: Vertical lettering "FIRE EXTINGUISHER" on door; color red.
 7. Cabinet Mounting Hardware: Appropriate to cabinet.
- C. Wall Brackets: Manufacturer's standard J-type for wall-hung extinguishers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged units.
- C. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Prepare recesses for recessed cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. Install items in accordance with Manufacturer's directions. Install cabinets and wall brackets plumb and level at heights shown on Drawings.
- B. Comply with regulatory requirements and anchor securely.
- C. Verify that extinguishers are charged and tagged.
- D. Place extinguishers in cabinets and on wall brackets.

3.04 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 10 51 00

METAL LOCKERS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Installation of Owner Furnished standard duty, multi-tier metal lockers of configurations indicated on Drawings.
- B. Related Sections:
 - 1. Section 10 51 56 – Turn-Out Gear Storage, for turn-out gear storage and fire hose storage racks.

1.02 SUBMITTALS

- A. Product data and installation instructions for locker units.
- B. Shop Drawings that show locker locations and relation to adjacent surfaces. Show lockers in detail, method of installation, fillers, trim, base, and accessories. Include locker numbering sequence information.

1.03 QUALITY ASSURANCE

- A. Uniformity: Provide lockers that are standard products of single manufacturer with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.
- B. Regulatory Requirements:
 - 1. ANSI A117.1, 2009 "Accessible and Usable Buildings and Facilities."
 - 2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
 - 3. 2010 ADA Accessibility Guidelines (ADAAG).
 - 4. The Arizonans with Disabilities Act of 1992 Administrative Rules (AzDAAG)
- C. Designated ADA compliant units shall be affixed with "handicap accessible" label on door.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Do not deliver lockers until building is enclosed and ready for locker installation.
- C. Storage and Protection: Adequately protect against damage during delivery, handling, storage, and installation.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements.

PART 2 PRODUCTS

2.01 HEAVY DUTY LOCKERS

- A. Heavy Duty Lockers: Owner furnished multi-tier metal lockers in configuration indicated on Drawings for installation by Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 2. Verify that prepared bases are in correct position and properly sized.

3.02 INSTALLATION

- A. Install metal lockers and accessories at locations shown plumb, level, square and flush in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Anchor lockers to floor and wall at 48 inches or less, as recommended by the manufacturer.
 - 1. Secure units to wall through back of units to solid blocking or studs or other solid structure with suitable anchors to resist 100 pounds pullout force.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install sloping tops, end panels and fillers using concealed fasteners. Size trim units in field and scribe to adjacent surfaces. Provide flush hairline joints against adjacent surfaces.
- E. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.
- F. Install number plates after installation to assure proper number sequence.

3.03 ADJUST AND CLEAN

- A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.
- B. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.
- C. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

3.04 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 10 51 56
TURN-OUT GEAR STORAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Turn-out gear lockers
 - 2. Hose storage racks.
- B. Related Documents: Refer to the GearGrid Fire Take-Off form attached to this Section.

1.02 SUBMITTALS

- A. Product data and installation instructions for locker units.
- B. Shop Drawings showing equipment locations and relation to adjacent surfaces. Show lockers and racks in detail, assemblies, method of installation, trim, base, and accessories.
- C. Samples: Submit 2 samples or color chart for color selection.

1.03 QUALITY ASSURANCE

- A. Provide standard products of single manufacturer regularly engaged in the manufacture of specified equipment with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Do not deliver lockers until building is enclosed and ready for locker installation.
- C. Storage and Protection: Adequately protect against damage during delivery, handling, storage, and installation.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of the following Manufacturer, except as approved by the Architect, subject to compliance with Specification requirements:
 - 1. Firefighters Gear Lockers:
 - a. GearGrid, LLC www.geargrid.com.

2.02 LOCKERS

- A. Wall Mount Lockers: GEARGRID Jumbo wall mounted and mobile gear lockers in quantity and location indicated on Drawings.
 - 1. Jumbo Size: 24 inches W. x 20 inches Deep x 74-1/2 inches high.
 - 2. Adjustability: Wire shelves adjustable in 3 inch increments.
 - 3. Frame: Heavy-duty 1-1/4 inch tubing.
 - 4. Side and Back Grids: High-strength 1/4 inch wire.
 - 5. Name Plate: 20 GA sheet metal, accepts 2 inch x 16 inch custom printed name plate.
 - 6. Mounting Brackets: 11 GA. Steel.
 - 7. Finish: Durable TGIC powder coat.
 - a. Color: As selected by Architect.

- B. Shelves and Accessories:
 - 1. Shelves/Hooks: Two shelves, upper and lower, constructed of high-strength 1/4" wire, and three apparel hooks per locker including coat drying hanger and glove drying hanger.
 - 2. Horizontal hang bar.
 - 3. Helmet holder.
 - 4. Provide additional items identified in the "GearGrid Fire Take-Off" form attached to this Section.

2.03 HOSE RACK

- A. Hose Rack: Heavy duty hose rack, steel framed with wire infill panels. Capable of supporting up to 3,800 lbs. Designed to accommodate hose sizes from 1-1/2 inch to 5 inches.
 - 1. Dimensions 73-1/4 inches wide by 26 inches deep by 82 inches high.
 - 2. Three sections wide for hoses only.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 2. Verify that prepared bases are in correct position and properly sized.

3.02 INSTALLATION

- A. Assemble and install lockers in accordance with Manufacturer's recommendations and approved Shop Drawings.
- B. Install plumb and square and bolt units together. Secure to substrate with suitable anchors to resist 100 pounds pullout force.
- C. Touch up minor blemishes as approved. Verify that doors and latches operate easily and properly.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

(attachment 1 – GearGrid Fire Take-Off form)

SECTION 10 73 23

VEHICLE SHADE CANOPIES

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

- A. Design Criteria: Steel vehicle shade canopies shall be engineered to withstand the minimum design loads for seismic, dead load, roof live load, wind loads, and soil bearing capacity as indicated in the General Structural Notes on the Structural Drawings.
- B. Application for Design Loads: Design loads shall be applied to the steel bent base plate and anchor points.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings for fabrication and erection of canopy assemblies, which are not completely shown by Manufacturer's data sheets, certified and sealed by a Structural Engineer registered in the State of Arizona. Include plans and elevations, details of sections and connections showing anchorage and accessory items.
- B. Test Reports: Submit two copies of applicable testing reports.
- C. Engineering Calculations: Submit three copies of design calculations for foundations and structure certified and sealed by a Structural Engineer registered in the State of Arizona.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall have not less than 5 years experience in manufacturing steel shade canopy structures consisting of prefabricated, pre-engineered, full cantilevered design for Projects of equivalent size and complexity as required by the Drawings and Specifications.
- B. Installer's Qualifications: Installer shall submit evidence of not less than 5 years experience installing pre-engineered car shelters.
- C. Standards: Comply with the following:
 - 1. Metal Building Manufacturer's Association (MBMA) "Recommended Design Practices Manual".
 - 2. American Institute of Steel Construction (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
 - 3. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members."
- D. Regulatory Requirements: Comply with 2012 IBC and local building code as applicable.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.

- B. Storage: Adequately protect against damage while stored at the site. Store out of contact with ground and provide air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
 1. Baja Construction Inc. www.bajacarports.com
 2. Gort Metal Products www.gortmetals.com
 3. Skyline Steel www.skylinesteel.com
 4. U.S. Prefab, Inc. www.usprefab.com
 5. Park and Shade, Marana, AZ 85658 (602) 316-6032.
 6. As approved by Architect or Owner.

2.02 MATERIALS

- A. Structural Steel: ASTM A572, A992, or A36 as standard with manufacturer.
- B. Structural Sheet Steel: ASTM A446 zinc-coated galvanized by hot-dip process.
- C. Sheet Steel: ASTM A525, G90.
- D. Steel Tubes: ASTM A500, Grade B, hot-dip galvanized.
- E. Bolts: ASTM A307 or A449 as required by design and structural analysis. Use of A325 or A490 bolts shall conform to the requirements of AISC Specifications.
- F. Sleeves: Machined from solid steel to meet the requirements of ASTM A500, Grade B (Fy = 42 ksi).
- G. Purlin Seats and Fittings: Fabricated from ASTM A36 hot rolled steel.
- H. Concrete and Reinforcing: As specified in Section 03 30 00.
- I. Paint: Factory applied baked polyester for roof deck and trim, and rust-inhibitive primer for structural steel.

2.03 FABRICATION

- A. Provide prefabricated steel canopy structures of rigid frame, single post single and double cantilevered type as indicated on Drawings, with frames constructed of steel. Include purlins, metal trim shapes, continuous custom fascia trim, bolts, fasteners, and corrugated galvanized steel roof covering. Size members per design requirements.
 1. Deck: 26 gauge minimum.
 2. Fascia and Trim: 29 gauge.
- B. Provide structure with dimensions and roof slope as indicated. Frame and covering may be matched and prepunched to receive fasteners, or drilling of holes for fasteners may be performed in field.

2.04 FINISHING

- A. Clean ferrous surfaces of oil, grease, loose rust, loose mill scale, and other foreign substances and shop prime. Prime in accord with Manufacturer's standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Erector shall examine supports, work areas and conditions under which the Work is to be installed prior to assembly and erection. If conditions are unsatisfactory, erection shall not proceed until satisfactory corrections have been made.

3.02 INSTALLATION

- A. Install steel canopy structures and related accessories in accordance with the Manufacturer's Erection Drawings and recommendations.
- B. Concrete Foundations: Form, reinforce and place concrete in accordance with Division 03 Concrete Sections.
- C. Coordinate installation of vehicle shade canopies with installation of lighting and related electrical equipment, conduit and boxes to be mounted on car shelters. Refer to Electrical Drawings and Division 26 Specifications.
- D. Set anchor bolts accurately by template while concrete is in a plastic state. Provide uniform bearing under base plates and sill members using a nonshrink grout when necessary. Calk base plate to foundation with sealant. Space members accurately to assure proper fitting of covering. As erection progresses, fasten and brace Work to resist dead load and wind and erection stresses.
- E. Isolate dissimilar materials by means of gaskets or isolating compounds. Plug improper or mislocated drill holes with an oversize screw fastener or with a gasketed washer. Sheets with an excess of holes or with holes in critical locations will be rejected. Keep exposed surfaces clean and free from sealants and foreign materials.
- F. Install framing true to line, level and plumb.
- G. Take adequate care during the erection sequences to insure members are not positioned by force or erected in a manner which causes secondary stresses.
- H. Provide adequate temporary bracing and supports to insure the structures stability during erection.
- I. Retain protective wrap on prefinished metal trim and accessories through the erection process.
- J. Completed structures shall comply with approved erection tolerances and Shop Drawing requirements.

3.03 PROTECTION

- A. During erection and until inspection, protect the structure from damage.
- B. Remove bent or distorted members and replace with new, undamaged members.
- C. Upon completion and inspection, protect the car shelter from damage during the remainder of construction on the Project and until Owner acceptance.

3.04 INSPECTION

- A. Completed steel vehicle shade canopy structure shall be inspected by trained representative of the Manufacturer and certified by the Manufacturer that the finished product has been manufactured and erected in accordance with Manufacturer's approved erection Drawings and the Contract Documents.

3.05 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.
- B. Touch up paints immediately after assembly. Apply air dry touch up paint to damaged finish material handling and/or erection of the car shelter.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Internal halyard ground set flagpole, including baseplate and foundation sleeve.
- B. Related Sections:
 - 1. Division 03 Concrete Sections for concrete foundation and foundation sleeve.
 - 2. Division 26 – Electrical, for ground-set up-lighting for light poles.

1.02 SYSTEM DESCRIPTION

- A. Design Requirements: Comply with National Association of Architectural Metal Manufacturer's "Guide Specifications for the Design of Metal Flagpoles," Standard FP-1.

1.03 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing sizes, finishes, methods of installation and accessories.
- B. Samples: Submit samples showing material and finish.
- C. Manufacturer's calculated engineering data for base.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
 - 1. American Flagpole Division, Kearney-National www.americanflagpole.com
 - 2. Baartol www.baartol.com
 - 3. Concord Industries www.flagpoles.com
 - 4. Eder Flag Manufacturing co., Inc. www.ederflag.com
 - 5. Ewing Group www.ewinggroup.com
 - 6. Morgan-Francis Div. www.morgan-francis.com
 - 7. The Flag Company, Inc.; Flag Pole Warehouse www.flagwarehouse.com
 - 8. Pole-Tech Co., Inc. www.poletech.com

2.02 FLAGPOLES

- A. Poles: Cone tapered aluminum ground set of seamless cold drawn ASTM B241, 6063-T6 aluminum tubing with 0.188-inch wall thickness, with base and top diameter as required for height(s) of poles specified.
 - 1. Height(s): As scheduled on Drawings.
- B. Accessories: Equip pole with the following:
 - 1. Internal Halyard Fittings: Manufacturer's standard cable based internal halyard and winch mount system with locking door and reinforced door frame assembly.
 - 2. Truck Assembly: Single sheave, revolving truck assembly.
 - 3. Ball: 14 gauge bronze anodized spun aluminum flag pole ball ornament of diameter to be compatible with height of pole and no larger than butt (bottom) diameter of pole.
 - 4. Provide upgraded 1/4 inch thick Bronze anodized aluminum casting base.
- C. Pole and Hardware Finishes: Manufacturer's standard medium bronze anodized aluminum finish.
- D. Foundation: 16 gauge corrugated galvanized foundation tube with self-centering bottom plate and hardwood or resilient wedges and lightning protector ground spikes, as shown on Drawings.
- E. Concrete: 3,000 psi minimum unless otherwise noted on Drawings, meeting requirements of Section 03 30 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

3.02 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with heavy coat of bituminous paint or manufacturer's standard protective bituminous tape.

3.03 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with Manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Install foundation plate and centering wedges for flagpole base set in concrete and fasten. Fill foundation tube sleeve with sand and compact.
- D. Allow concrete to cure at least 14 days before erecting pole.

3.04 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 11 31 00
RESIDENTIAL EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes residential grade kitchen and laundry equipment and appliances.
- B. Related Sections:
 - 1. Divisions 23 and 26 for utility piping and electrical outlets for equipment and appliances.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's specifications and installation instructions.
- B. Shop Drawings: Submit drawings showing space requirements, and piping and wiring rough-in locations for gas, water, power, and for ductwork.
- C. Samples: Submit samples or brochures showing color selection.
- D. Operating and Maintenance: Submit 2 copies of Manufacturer's instructions for operating and maintaining equipment.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.04 WARRANTY

- A. Furnish Manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Kitchen and Laundry Equipment and Appliances: Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with specifications requirements:
 - 1. General Electric www.ge.com
 - 2. Whirlpool www.whirlpool.com
 - 3. Frigidaire www.frigidaire.com
 - 4. In-Sink-Erator www.insinkerator.com

2.02 EQUIPMENT

- A. As scheduled on Drawings and as selected by Owner and Architect under the allowance included in the Construction Estimate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install equipment at locations shown on Drawings in accordance with Manufacturer's instructions.
- B. Connect equipment to power, water and ductwork rough-ins as applicable. Securely fasten built-in items where required.

3.03 FIELD QUALITY CONTROL

- A. Tests: Test each item for proper operation. Check and adjust oven thermostats for correct temperature.

3.04 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 11 52 00
AUDIO VISUAL EQUIPMENT

PART 1 GENERAL

1.01 SUBMITTALS

- A. Product Data: Submit Manufacturer's descriptive brochure for each item.
- B. Shop Drawings: Submit Drawings showing construction and installation details for projection screens.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's directions.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Projection Screen: As scheduled on Drawings or as otherwise selected by Architect and/or Owner.
- B. Television Support Brackets: As scheduled on Drawings or as otherwise selected by Architect and/or Owner.
- C. Projector Support Brackets: As scheduled on Drawings or as otherwise selected by Architect and/or Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install items in accordance with details on Drawings and Manufacturer's installation instructions.
- B. Securely fasten wall and ceiling mounted items to solid backings, blocking, or supports.

- C. Mount television bracket with bottom of bracket height as shown on the Drawings. Bracket and mounting plate to be firmly supported by and attached to two 16 ga. structural steel studs running from the floor to the structure above.

END OF SECTION

SECTION 12 21 00

BLINDS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Aluminum, horizontal blinds as shown on the Drawings and as specified.

1.02 SUBMITTALS

- A. Samples: Submit samples of blind materials, colors and patterns.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage and Protection: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements; proper fit and attachment of parts is required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as otherwise specified approved by the Architect, subject to compliance with Specification requirements:
1. Graber or Bali Brands, Springs Window Fashions
www.springswindowfashions.com
 2. Hunter Douglas Inc. www.hunterdouglas.com
 3. levolor Kirsch Window Fashions, Levolor Corporation www.levolor.com

2.02 HORIZONTAL MINI-BLINDS

- A. Aluminum, Horizontal Blinds: Graber 1-inch horizontal Blinds, or as otherwise approved by Architect.
1. Slats: 5000 Series cold-rolled aluminum with recycled content. Nominally 1.00 inches wide x .006-inch-thick, processed with Advanced Finishing Technology (AFT), providing a smooth, hard, less porous Surface.
 - a. Finish: Topcoat of polyester baked enamel in color scheduled on Drawings or as otherwise selected by Architect from manufacturer's full range of standard colors.
 2. Headrail: 1-inch high x 1-inch wide x .025-inch thick U-shaped steel.
 1. Finish: Phosphate treatment, chrome-free sealer, HAP urethane primer and polyester baked topcoat in color as selected to match slats.

3. Tilter: Injection-molded thermoplastic with clutch mechanism to prevent damage due to over-tilting.
4. Tilt Rod: Electro-zinc coated solid steel, 1/4-inch square.
5. Tilt Wand: Clear polycarbonate, hexagonal cross section, approximately 1/4-inch diameter. Spring clip attachment to tiler shaft.
6. Cord Lock: Snap-in design metal incorporating a floating, shaft-type locking pin. Crash proof safety feature to lock blind automatically upon release of cord.
7. Drum and Cradle: Low-friction thermoplastic. Proved for each ladder.
8. Installation Brackets: Rivet-hinged front cover with finish matching headrail.
9. Braided Ladders: 100 percent polyester yarn incorporating two extra strength rungs per ladder for slat support. Standard spacing of 22.5mm.
10. Bottom Rail: Tubular shape, 0.25-inch-thick, finish matching slats.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination with other Work: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install window blinds in strict accordance with Manufacturer's instructions. Install straight and plumb, securely fastened, and with horizontal and vertical lines level and true with window framing.
- B. Evidence of drilling, cutting and fitting to room finish shall be concealed in the finish work. Provide uniform clearance at edges not to exceed 3/16 inch. Adjust hardware for smooth operation.
- C. Install blinds between vertical window mullions with discontinuous head channel and slats, allowing independent blind operation for separate glazing units, unless otherwise indicated on Drawings.

3.03 CLEANING

- A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 12 31 00

MANUFACTURED METAL CASEWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Custom fabricated stainless steel casework and countertops as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Section 06 40 00 – Architectural Woodwork, for plastic laminate faced casework.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Drawings showing layout, dimensioned plans and elevations, adjacent conditions, large-scale details, hardware, and attachment devices.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and cutouts and holes for plumbing fixtures, faucets, and other items.
 - 3. Indicate hardware locations and types.
 - 4. Indicate locations of and clearances from adjacent walls, finishes and equipment.
- B. Samples:
 - 1. Submit samples of stainless steel sheet to be used in specified finish and thickness.
 - 2. Submit one Sample of each type of hardware specified or required.
- C. Qualification Data: For fabricator.

1.03 QUALITY ASSURANCES

- A. Qualifications: Manufacturer shall be company specializing in manufacturing the products specified in this Section with minimum 5 years documented experience.
- B. Source Limitations: Obtain stainless steel casework, including countertops, through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 19 – Project Meetings.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.
- C. Storage: Adequately protect against damage while stored at the site.
- D. Handling: Comply with Manufacturer's instructions.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Where stainless steel casework is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that stainless steel casework can be supported and installed as indicated.

1.07 WARRANTY

- A. Furnish written warranty that stainless steel casework, including hardware, shall remain free from defects in material or workmanship for a period of two (2) years from date of substantial completion of Project and shall be removed and replaced without cost or expense to Owner. Defects include, but are not limited to the following:
 1. Slippage, shift, or failure of attachments to wall, floor, or supporting construction.
 2. Weld or structure failure.
 3. Warping or unloaded deflection of components.
 4. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish manufactured metal casework of one of the following Manufacturers, or as otherwise pre-approved by the Architect, subject to compliance with Specification requirements:
 1. LOC Scientific www.locscientific.com
 2. Kloppenburg & Co. www.kloppenbergl.com
 3. Kewaunee Scientific Corporation www.kewaunee.com
 4. Mott Manufacturing www.mott.ca
 5. As approved by Architect.

2.02 MATERIALS

- A. Stainless Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard flatness.
 1. Minimum Nominal Stainless Steel Thickness for Stainless Steel Casework: .0625 inch (16 gauge), except 18 gauge may be used for backed countertops.
 2. Finish: ANSI No. 4 Brushed Finish, unless otherwise indicated on Drawings.

2.03 HARDWARE

- A. General: Provide metal casework manufacturer's standard brushed stainless steel finish, commercial-quality, heavy-duty hardware equal to or complying with products specified.
- B. Shelf Standards and Supports for Cabinet Mounted Shelving: K&V 255 standards and 256 supports.
- C. Drawer and Door Pulls: Stainless steel, wire pulls; 4 inches long; 5/16 inches in diameter; and fastened from back with 2 screws. Provide 2 pulls for drawers more than 24 inches in width.

- D. Drawer Slides: All drawer glides shall be Accuride Eclipse Easy-Close, full extension, 150 lb. capacity minimum for all applications.
- E. Hinges: Other function hinges may be submitted for approval for special circumstances.
 - 1. ANSI-A156.9, B01612 – concealed hinge, self closing with soft close, 120 to 125 degree of opening, full overlay type for screw attachment complete with mounting plates. Blum Clip Top m120 deg.+ with Add-On Blumotion Soft Close, or equal as manufactured by Mepla, Salice, or Hettich.
 - 2. Other function hinges may be submitted for approval for special circumstances.
- F. Door Catches: Nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches in height.
- G. Locks: National C8138 for drawers; National C8123 for doors.
- H. Heavy-Duty Standard and Brackets for Pantry Shelving: Herman Miller, or equal.
- I. Provide all other hardware as necessary to fulfill function of architectural woodwork and cabinets as shown on Drawings, subject to approval by Architect.
- J. Finish: ANSI No. 4 Brushed Finish, unless otherwise indicated on Drawings.

2.04 FABRICATION

- A. General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Integrally frame and weld to form a dirt and vermin-resistant enclosure. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch. Exposed fasteners are not allowed.
 - 1. Sizes and Configurations: As indicated on Drawings.
 - 2. Fabricate casework from .0625 inch (16 gauge) stainless steel.
 - 3. Fabricate “L” shapes front corner reinforcement gussets and hinge reinforcements from .0781 inch (14 gauge) stainless steel.
 - 4. Fabricate bottom leveler gussets from .1250 inch (11 gauge) stainless steel.
 - 5. All cabinets shall have a cleanable smooth interior. Front and rear reinforcing members, and channel shaped uprights shall be enclosed full height.
 - 6. Front face joints shall be fully welded, ground smooth and polished to provide a continuous flat front plane free of crevices.
 - 7. Where necessary, provide removable back panels for access to stops, valves, junction boxes, and service lines.
 - 8. Provide one-piece die-formed cabinet bottom construction with return side flanges turned down. Spot weld flanges to cabinet sides.
 - 9. Cabinet bottoms shall be turned down at front to form 1-1/4 inch U-channel to accept stainless steel toe kick.
 - 10. All base cabinets shall be supported on (4) adjustable leveling glides.
 - 11. Bottom of base cabinets shall be removable to provide access to leveling glides or punched 3/4 inch dia. Corner holes to access levelers and to accept stainless steel or PVC press plugs.
- B. Flush Doors: Outer and inner pans that nest into box formation, with full height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material. Provide recessed block-outs in door backing plate to accept hinges.

- C. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Weld drawer front to sides and bottom to form a single, integral unit. Provide drawers with rubber bumpers, ball-bearing slides, and positive stops to prevent metal-to-metal contact or accidental removal.
- D. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.
- E. Stainless Steel Countertops: Fabricate counters with integral sinks, sizes as indicated. Provide with square edges as detailed on Drawings.
 - 1. Connections shall be shielded arc welded and ground smooth to match adjacent surfaces.
 - 2. Reinforce as necessary for rigidity.
 - 3. Fabricate in largest sections practicable, with integral back and end splashes as indicated.
 - 4. Fabricate counters with backing material of plywood or MDF as specified. Provide Marine Grade plywood at countertops with sinks or within 24 inches of sink.
 - 5. Coat back of stainless steel assemblies with sound deadening material. Provide with mounting hardware as appropriate to the installation and as necessary.
- F. Provide cutouts, rough openings, and recesses for appliances, outlet boxes, lighting fixtures, plumbing components, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges. Extend J-boxes as required by NEC.
- G. Provide closure panels, scribes, and fillers formed from .0625 inch (16 gauge) stainless steel, secured to cabinet without exposed fasteners.
- H. Provide stainless steel backsplash and wall cladding between base and upper cabinets. Return all exposed edges.

2.05 ACCESSORIES

- A. Adhesives:
 - 1. Laminate Adhesive: 3M Fastbond 30, or equivalent to suit application.
 - 2. Wall Panel Adhesive: Cartridge type compatible with paneling and wall substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of metal casework.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install level, plumb, and true; shim as required, using concealed shims. Where metal casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

- B. Base Cabinets: Adjust top rails and subtops within 1/16 inch of a single plane. Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

- C. Wall Cabinets: Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c. Align similar adjoining doors to a tolerance of 1/16 inch.
- D. Install countertops level and aligned with base cabinets. Attach to base cabinets with concealed fasteners.
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- F. Adjust metal casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.
- G. Comply with requirements in Division 22 Sections for installing water service fittings and piping.
- H. Adhere stainless steel backsplashes and wall panels with adhesive.

3.03 ADJUSTING

- A. Repair or replace defective work, as directed by Architect or Owner's Representative at completion of installation.
- B. Adjust doors, drawers, and hardware to function smoothly.

3.04 CLEANING

- A. Clean finished surfaces. Touch up as required and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 12 36 61

SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Solid surfacing material countertops, backsplashes, and similar items as indicated on Drawings and as specified.
- B. Related Sections:
 - 1. Section 06 40 00 – Architectural Woodwork, for subtops for solid surfacing material countertops.

1.02 SUBMITTALS

- A. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
- B. Shop Drawings: Indicate dimensions, component sizes, edge details, fabrication details, locations and dimensions of cutouts, required locations of support and blocking members, attachment provisions and coordination requirements with adjacent work.
- C. Samples: Submit two (2), 12-inch x 12-inch samples of each color/finish of solid surfacing material required.
- D. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

1.03 QUALITY ASSURANCE

- A. Fabricator/Installer Qualifications:
 - 1. Certified or approved by the Manufacturer.
 - 2. Subject to approval by Architect.
 - 3. Have adequate physical facilities and sufficient production capacity to produce, transport, deliver, and install the required units without causing delay in the work.
 - 4. Have a minimum of 2 years of fabrication experience.
- B. Fire Test Response Characteristics: Provide materials with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspection agency acceptable to authorities having jurisdiction:
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed Index: 450 or less.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation. Store indoors in a dry area and away from extreme temperatures.
- B. Deliver materials and accessory products in manufacturer's unopened containers.

- C. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.05 WARRANTY

- A. Provide manufacturer's ten year limited warranty against visible defects and failure due to manufacturing defects. Damage caused by physical or chemical abuse or damage from excessive heat is excluded from warranty. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish solid surfacing materials of the following manufacturer as scheduled on the Room Finish Legend on Drawings, or equivalent prior approved by Architect:
 - 1. Corian as manufactured by Du Pont, Inc. www.dupont.com

2.02 MATERIALS

- A. Solid Surfacing Material: Manufacturer's proprietary formulation of fully densified composite of modified polymer resins and mineral fillers with through body colors meeting ANSI Z124.3 or ANSI Z124.6.
 - 1. Color and Finish: As scheduled on Room Finish Schedule on Drawings by reference to Manufacturer's proprietary color and finish designations, or equivalent as approved by the Architect.
 - 2. Thickness: Fabricated from 1/2-inch-thick material minimum.
 - 3. Provide edge details of profiles shown on the Drawings. Ease edge slightly where edge is indicated to be square.
 - 4. Provide backsplashes, where shown on the Drawings, to dimensions shown on the Drawings.
- B. Provide edge details of profiles shown on the Drawings.
- C. Provide backsplashes, where shown on the Drawings, to dimensions shown on the Drawings.
- D. Superficial damage to a depth of 0.010 inch (.25mm) to solid surfacing materials shall be repaired by sanding and/or polishing.

2.03 ACCESSORY PRODUCTS

- A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints. Color to match fabrication material.
- B. Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967 and UL(R) listed.
- C. Sealant:
 - 1. For conditions exposed to moisture; Manufacturer's standard mildew-resistant, FDA/UL(R) recognized silicone sealant in colors matching components.
 - 2. For conditions not exposed to moisture; Manufacturer's standard silicone sealant in colors matching polymer material.

2.04 FABRICATION

- A. Fabricate components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
- B. Form units with integral thermal formed sinks of type, size and profile indicated on Drawings.
- C. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints. Reinforce joints with 2 inch strip of engineered quartz material.
 - 1. Avoid joints within 1 inch of inside or outside corners.
- D. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings. Coordinate with scheduled and specified plumbing fixtures and toilet room accessories.
- E. Cut, rout and finish component edges with clean, sharp returns. Rout radii and contours to template. Repair or reject defective and inaccurate work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and manufacturer's installation instructions.
- B. Provide materials in largest pieces available to minimize field joints.
- C. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- D. Cut and finish component edges with clean, sharp returns. Rout radii and contours to template.
- E. Anchor securely to base cabinets or other supports as indicated.
- F. Align countertops and form seams to comply with manufacturer's printed recommendations using adhesive in color to match countertop.
- G. Install countertops with no more than 1/8 inch sag, bow or other variation from straight line.
- H. Provide backsplashes and sidesplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant and panel adhesive.

- I. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- J. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.

3.03 PROTECTION

- A. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work that cannot be repaired to Architect's satisfaction.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 12 93 00
SITE ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Bicycle racks.
 - 2. Backflow preventer security cages.
 - 3. Splash blocks.
 - 4. Other items as may be indicated on Drawings.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data showing products selected.
- B. Samples: Submit samples of selected colors for verification purposes.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SITE ACCESSORIES

- A. Bike Racks: Provide products scheduled on Drawings.
 - a. Finish: Manufacturer's standard TGIC powder coat finish in color as selected by Architect from manufacturer's standard available colors.
- B. Backflow Prevention Device Enclosures: Provide enclosure cover of type and size indicated on Drawings, as manufactured by Backflow Prevention Device Inspection, Inc (BPD) www.bpdiaz.com, or Guardshack Enclosures www.guardshackenclosures.com
- C. Precast Concrete Splash Blocks: Plant-cast, 5,000 psi, air-entrained concrete splash blocks, size as indicated on Drawings by 3 inches deep with formed dish shape to direct water away from building.

2.02 INSTALLATION ACCESSORIES

- A. Installation Accessories: As recommended by or provide by the accessory manufacturer for the type of installation indicated, and as follows:
 - 1. Mechanical Anchors: In accordance with Section 05 50 00.

2. Epoxy Anchor Bolt Adhesive: Commercial grade, 2-component, non-sag, moisture insensitive, high-strength structural epoxy. Acceptable products include, but are not limited to the following:
 - a. Quikrete Hs Anchor Epoxy.
 - b. Simpson Strong-Tie Set-XP.
 - c. ITWRedHead G5 High Strength Epoxy.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Handle and install site accessories in accordance with manufacturer's recommendations and installation instructions.
- B. Bike Racks: Surface mount units at locations indicated with powder actuated fasteners in accordance with manufacturer's instructions.
- C. Backflow Prevention Device Enclosures: Set units at each backflow prevention device or water valve as indicated on Drawings and in accordance with manufacturer's instructions using theft resistant fasteners to concrete base secured with epoxy anchoring adhesive.
- D. Splash Blocks: Place on finished grade below each roof downspout location as indicated on Drawings.

END OF SECTION

SECTION 210000 - FIRE PROTECTION SPECIFICATION
(Wet Automatic Sprinkler System)

PART 1 GENERAL

1.1 General Conditions and Special Conditions:

- A. Bidding requirements, general conditions, general requirements, appendices, and addendums apply to the work under this section as depicted in Project Specification Manual.

1.2 General Description:

- A. Provide all materials, labor, and equipment required for new Wet, Automatic Sprinkler (A.S.) system in accordance with the Local Fire Marshal, National Fire Protection Association (NFPA), International Building Code (I.B.C.), and the Buckeye Fire Department. It shall further include furnishing and installing all miscellaneous items required for the proper operation of the A.S. system, whether specifically called for or not. Install and deliver all systems complete, in perfect working order, and in full accordance with the intent and meaning of the specifications and/or drawings.
- B. This Contract shall begin at point of connection to the underground riser supply line. Coordinate required work with Utility Contractor. This point of connection may occur at 5'-0" beyond building or at flange connection at base of riser.

1.3 Intent of Specifications:

- A. It is intended that the work performed pursuant to these specifications shall be complete in every respect; resulting in a system installed entirely in accordance with all current applicable codes, standards, manufacturer's recommendations and U.L. listings and FM approvals. All work in general consists of, but is not necessarily limited to, these specifications and latest accepted code approved design and installation standards.
- B. It is further intended that upon completion of work, the Owner shall be provided with the following:
 - 1. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, trouble-shooting, and expanding the system at a future date.
 - 2. Complete documentation of system testing.

3. Written certification that the system has been tested and inspected, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations, U.L. listings, F.M. approvals, etc. and is in proper working order.
4. It is intended that the Contractor be responsible for work with other trades.

1.4 Related Work Provided by Other Sections:

- A. The following related work shall be performed under other sections:
 1. Painting of sprinkler piping and valves, including the placement and removal of bags or other protection devices on sprinklers to prevent paint from touching any portion of the sprinkler.
 2. Alarm system shall be provided by Electrical and/or Alarm Contractor(s).
 3. Concrete filled pipe guard posts for protection of riser(s), backflow assembly, etc. shall be provided where equipment or materials are subject to vehicular traffic.
 4. Concrete splash blocks at main drain, inspector's test outlets and auxiliary drain outlets, if necessary.

1.5 Work to be Performed:

- A. Complete automatic sprinkler system protection throughout the project in accordance with these specifications and drawings.
- B. Be fully informed regarding all regulations and limitations of the spaces available for installation of the automatic sprinkler system. Later claims for labor, work, material, and equipment required for any difficulties encountered that could have clearly been foreseen will not be recognized, and all such difficulties shall be properly handled by this Contractor at no additional cost to the Owner.
- C. Valve diagrams, pipe markers, metal signs and riser design placards.
- D. Operating and maintenance manual.
- E. New 2-way siamese-type fire department connection (F.D.C.) for A.S. system with National Standard Threads (P.H.T.) as required by local fire department. Provide with check valve. Automatic drip is required if F.D.C. is not remotely located.
- F. Install A.S. system waterflow indicating equipment and valve supervisory devices on all devices and valves. Wiring shall be by Electrical and/or Alarm Contractor(s).

- G. Inspector's test and auxiliary drain locations necessary to test and completely drain each A.S. sprinkler system.
- H. Shop drawings, fabrication drawings (if Contractor chooses to submit), equipment submittals, record drawings and other submittals required herein.
- I. Testing of new A.S. system.
- J. Guarantee all new equipment and systems for a one year period after date of substantial completion as determined by Architect, Owner or His/Her Agent and Contractor.
- K. Repair all damage resulting from this work. Including all materials, fittings and fixtures. All pipe openings shall be closed so as to prevent obstructions and damage.
- L. Sleeves and related fire rated seals and waterproofing commensurate with the penetration.
- M. Inserts, hangers, clamps, sway bracing, etc., as required to hang and support piping in accordance with NFPA and/or this specification.
- N. Accuracy of pre-fabricated pipe, location of sprinklers and deflectors (per NFPA and inspections), field fit of piping, piping elevations, riser nipple lengths and dimensioning.

1.6 Codes, Standards, Ordinances and Permits:

- A. All work shall conform to the requirements of the applicable portions of the National Fire Protection Association (NFPA) Standards and Recommended Practices (including Appendices) listed herein:
 - 1. NFPA-13, 2013 Edition, "Standard for the Installation of Sprinkler Systems".
 - 2. NFPA-291, 2013 Edition, "Recommended Practice for Fire Flow Testing and Marking of Hydrants".
 - 3. NFPA-24, 2013 Edition, "Private Fire Service Mains and their Appurtenances".
 - 4. NFPA-25, 2013 Edition, "Inspection Testing and Maintenance of Water-Based Fire Protection Systems".
- B. All work, materials, and equipment shall conform to all Local, State and Federal Codes as well as all other Authorities having jurisdiction. If alternate editions of aforementioned

standards, or additional standards are required then they shall be applied as accepted by Local and State codes.

- C. If there is a conflict between the referenced standards, codes, or Authorities having jurisdiction; then it shall be the Contractor's responsibility to bring the conflict to the attention of the Owner or his/her Agent immediately for resolution prior to commencement of any additional work. This conflict shall be resolved at no additional cost to the Owner.
- D. The Contractor shall be responsible for filing all documents, paying all fees and securing all permits, inspections and approvals necessary for conducting this work.

1.7 Quality Assurance:

- A. **Installer Qualifications:** Installation and alterations of fire protection piping, equipment, specialties, accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with all precautions required and has complied with all the requirements of the Authorities having jurisdiction. Installer shall be licensed with the State and Local Authorities having jurisdiction. Submit evidence of such qualifications to the Owner or his/her Agent with submission of bid.

1.8 Definitions:

- A. **Contractor:** The Fire Protection Contractor and any of his/her sub-contractors, vendors, suppliers, or fabricators.
- B. **Provide:** Furnish and install.
- C. **Furnish:** Purchase and deliver to other trades or Owner for installation.
- D. **Install:** Install materials, equipment or assemblies furnished by other trades or Owner.
- E. **Concealed:** Where used in connection with installation of piping and accessories, shall mean that hidden from sight as in chases, furred spaces, pipe shafts, or above suspended ceilings. "Exposed" shall mean "not concealed" as defined above.

F. Owner: Owner or his/her designated Representative.

G. Fire Protection Consultant:

Hunter Design & Consulting, Inc.
Contact: Gary McDaniel

1.9 Submittals:

- A. The Owner or his/her Agent, Architect and Fire Protection Consultant shall review all submittals for conformance to these specifications.
- B. Contractor may submit for review and approval any proposed substitution of materials or method of installation, from that specified, with material submittals.
 - 1. Proposed substitutions of method of installation shall be designed by a NICET Level III or IV Certified Engineering Technician or Technologist.
 - 2. Before proposed substitutions of method of installation are submitted to Architect for approval, they shall have the following specified stamps of approval: a. Local Fire Marshal.
- C. If submittals or proposed substitutions, upon review are found not to conform to the requirements of these specifications, the Contractor shall be required to resubmit with modification. Not approved items shall be resubmitted. The Contractor shall be responsible for the Owner's expenses for subsequent revisions of rejected submittals necessitated by the Contractor's failure to make the requested modifications. Such extra fees shall be deducted from payments by the Owner to the Contractor.

1.10 Manufacturer's Data:

- A. The Contractor shall submit with his/her bid, manufacturer's data sheets showing the type and model of all equipment or material proposed. This information shall include, but not be limited to:
 - 1. Type of pipe.
 - 2. Hangers.
 - 3. Valves.
 - 4. Pipe fittings/joining methods.
 - 5. Sprinklers.
 - 6. Waterflow devices.

7. Supervisory devices.
8. Waterflow alarms.
9. Fire Department Connection(s).
10. Escutcheons.
11. Fire rated and waterproof penetration seals.
12. Pressure Gauges.
13. Nozzles (where required).

B. When a data sheet shows more than one product, the proposed product shall be clearly indicated by arrows or other suitable means. This includes sprinkler orifice sizes, finishes, and temperature ratings.

1.11 Shop/Fabrication Drawings:

- A. Within 30 days after award of contract, the Contractor shall submit six (6) sets of manufacturer's data sheets, catalog cut sheets and data on devices for all necessary approvals prior to fabrication of materials.
- B. Contractor shall submit complete packages. Partial submittals will be returned without further explanation.
- C. No extension of the contract time will be granted for the Contractor's failure to allow sufficient time for review and processing, or for shop drawings which have been returned due to improper submission.
- D. The Contractor will not be authorized to start any portion of the work until the shop/fabrication drawings, catalog cuts and other required submittals for that portion are received, reviewed, and approved by all required parties.

1.12 Operation and Maintenance Manual:

- A. The Contractor shall provide the Owner with a loose-leaf manual containing:
 1. A detailed description of the system.
 2. A detailed description of routine maintenance required or recommended or as would be provided under a maintenance schedule and detailed maintenance instructions for each type of device installed.
 3. Manufacturer's data sheets and installation manuals/instructions for all equipment installed.
 4. A list of recommended spare parts.
 5. Service Directory.
 6. 11-inch by 17-inch reduced copies of the "record" drawings.

- B. Within 30 days of the completion of the work, two (2) copies of the manual shall be delivered to the Owner.

1.13 Record Drawings:

- A. The Contractor shall maintain on the site an accurate record of all changes made to the system layout from that shown on the approved drawings.
- B. Upon completion of the work, before final approval, one (1) set of reproducible mylar "record" drawings and two (2) additional sets of blue line "record" drawings shall be delivered to the Owner. Contractor shall coordinate this with Architect.
- C. At least one set of approved drawings with all required stamps of approval shall be maintained on-site and made available to all Authorities having jurisdiction on demand during construction phase of work.

1.14 Valve Diagrams:

- A. At the completion of the work, provide a small scale of the building(s) indicating the location of all control valves, low point drain(s), and inspectors test(s). The plan shall be neatly drawn and color coded to indicate the portion of the building protected by each system, framed under glass (not plastic), and permanently mounted on the wall adjacent to each sprinkler riser.

1.15 Changes:

- A. Make no changes in installation from layout as shown on the approved drawings unless change is specifically approved by the Engineer. This does not include minor revisions for the purpose of coordination, or to clear ducts or obstructions.
- B. Any changes made other than stated above are at the Contractor's own expense and responsibility.

1.16 Leak Damage:

- A. The Contractor shall be responsible during the installation and testing period of the sprinkler system for any damage to the work by others, to the building, its contents, etc.

caused by leaks in any equipment, by unplugged or disconnected pipes, fittings, etc., or by overflow, and shall pay for the necessary replacement or repairs to work of others, damaged by such leaks.

1.17 Freight and Hauling:

- A. Deliver materials to the job site, unload, and store in location determined by the Owner's Representative and General Contractor.

1.18 Base Bid:

- A. The base bid shall be lump-sum or in accordance with Division I of specifications.
- B. The Contractor shall indicate the number of sprinklers included in the base bid, including the number of sprinklers allowed for obstructions and ductwork.

1.19 Cleanup:

- A. Maintain the premises free from accumulation of waste material or rubbish caused by this work.
- B. At the completion of the work, remove all surplus materials, grease, oil, etc. from piping, tools, etc., and leave premises in a neat, clean workmanlike manner.

1.20 Safety:

- A. All work shall be performed in compliance with the Occupational Safety and Health Act of 1970 and Construction Safety Acts Standards (or current).

1.21 Guarantee Period:

- A. The Contractor shall guarantee in writing (triplicate) all materials and workmanship for a period of one year beginning with the date of substantial completion. The Contractor

shall be responsible during the design, installation, testing and guarantee period for any damage caused by him/her (or his/her Subcontractors) or by defects in his/her (or his/her Subcontractor's) work, materials, or equipment.

1.22 Emergency Service:

- A. During the warranty period, the Contractor shall provide emergency repair service for the entire automatic sprinkler system. This service shall be provided on a 24-hour per day, 7 day per week basis. Coordinate details with Owner's Representative.

1.23 Spare Parts and Special Tools:

- A. Contractor shall install code approved metal sprinkler cabinet(s) containing sprinklers of all types, finishes, and temperature ratings used and two (2) sets of sprinkler wrenches compatible with each type of sprinkler provided. The cabinets shall be installed at the locations approved by the Owner and NFPA requirements. Sprinkler and cabinet quantities shall be per NFPA-13.
- B. The Contractor shall supply the Owner with two (2) complete sets of special tools and equipment necessary to perform routine maintenance on the sprinkler systems.

1.24 Final Approval and Acceptance:

- A. Final approval and acceptance of the work will not be given by the Owner until:
 - 1. The completed sprinkler system(s) has/have been inspected, tested and approved by the Owner, Architect, and all other Authorities having jurisdiction.
 - 2. Required submittals, system operation and maintenance manuals, "record" drawings, spare parts, and special tools have been provided to, reviewed, and accepted by the Owner.

PART 2 PRODUCTS

2.1 Design Criteria:

- A. Provide wet-pipe sprinklers in all areas as required by NFPA, Authorities having jurisdiction, these specifications and approved construction documents.

2.2 Sprinkler System Components - General:

- A. All equipment and system components furnished and installed shall be new and unused, of first quality, and be listed by Underwriters Laboratories Inc. and approved by Factory Mutual for their intended use. All such equipment and system components shall be installed within the limitations of the respective U.L. listings or FM approvals. Equipment and material used shall generally be from a consistent manufacturer.

2.3 Piping:

- A. Manufacturers:
 - 1. Wheatland Tube
 - 2. Bull Moose Tube Company
- B. Sprinkler system piping or tubing shall meet the requirements of NFPA 13, be U.L. listed and F.M. approved. Contractor shall base his/her bid on the use of any one or a combination of the following: In addition, all pipe shall have a minimum Corrosion Resistance Ratio (CRR) of 1.00 or greater, as per U.L. listings.
- C. Pipe meeting ASTM A-795 and/or A-135 requirements for above grade use. All piping shall be black carbon steel.
- D. Underground pipe and fittings (to riser flange or 5'-0" beyond building): Class 150 centrifugal cast iron enameling, or cement lined mechanical joint, "Tyton" joint, conforming to USAS A-21.6 (AWWA Specification C-106); or "Permastran" conforming to ASTM D 2992 and ASTM D 2996. Class 50 ductile iron pipe. Block underground piping, fittings and thrust blocks per NFPA - 24.
- E. Flanges and flanged fittings shall be 175 psi cast iron with standard ring gaskets.
- F. Pipe and fittings shall be listed by Underwriters Laboratories, Inc. and approved by Factory Mutual for use in fire protection systems and designed to withstand a working pressure of not less than 175 psi.

- G. All pipe and fittings exposed to the weather, downstream of all inspector's test valves, between exterior wall and check valve on FDC, or located in a corrosive atmosphere shall be hot-dipped zinc coated (galvanized).
- H. Flexible couplings shall be U.L. and F.M. approved.
- I. Pipe penetrations through masonry and fire rated construction shall be sleeved and sealed with fire rated seals commensurate with the building construction.
- J. Pipe penetrations through floors and exterior walls shall be approved waterproof seals.
- K. When system piping pierces a foundation wall below grade or is located under the foundation wall, clearance shall be provided to prevent breakage of piping due to building settlement. Do not locate pipe joints within or under a foundation wall and a 1-3 inch clearance shall be provided around piping by use of sleeve for piping piercing a foundation wall. Sleeve properly and fill clear space with approved waterproof packing.
- L. Use of foreign-made piping or fittings shall not be permitted.
- M. Use of copper or CPVC piping and fittings in accordance with NFPA-13 and pipe listing is permissible where prior-approved only.

2.4 Automatic Sprinklers:

- A. Sprinklers shall be of the listed automatic, glass bulb type, and shall be distributed throughout the building per code and approved construction documents.
- B. Sprinklers required due to ceiling projections/obstructions and ductwork are not considered additional sprinklers. Contractor shall be responsible for identifying these locations.
- C. Install ordinary, intermediate and high temperature sprinklers of proper degree rating wherever necessary to meet requirements of NFPA, and Authorities having jurisdiction.
- D. Provide corrosion resistant sprinklers with factory applied coating where sprinkler is to be located in a corrosive atmosphere (canopies, etc.).

- E. Sprinkler and escutcheon finishes shall be suitable for area or ceiling finish provided. Verify finish of all sprinklers and escutcheons with Owner or his/her Agent prior to ordering.

2.5 Inspector's Test Connections:

- A. Provide test connection at most remote portion of each A.S. system, with 1" pipe and valve. Test connection piping shall be connected to sprinkler branch line at least 1-1/4" in diameter and shall discharge outside building through smooth bore brass outlet. Outlet orifice shall be equal to smallest sprinkler orifice utilized in the sprinkler system.

2.6 Hangers:

- A. Use eye-rod and beam-clamp and rings and hang from top chord of joists. Do not hang from bottom chord of joist or bridging.
- B. Trapeze all mains if required. Verify all hanger types with Structural Drawings and Engineer prior to commencement of any work.
- C. Provide sway bracing. Install in accordance with NFPA-13. Pipe to be generally supported by clamps and rods and secured to overhead construction.

PART 3 EXECUTION

3.1 Starting and Completion Dates:

- A. The schedule for installation of the sprinkler systems will be established at the pre-bid meeting. Coordinate schedule closely with General Contractor, Owner, and Architect.

3.2 Inspection:

- A. The Contractor shall daily examine all areas in which the work will be performed. The Contractor shall immediately report unsatisfactory working conditions to the Owner or his/her Agent for resolution. The Contractor shall not proceed with the work until all unsatisfactory working conditions have been corrected.
- B. Owner, Architect, and all Authorities having jurisdiction shall be allowed to conduct inspections and tests as they choose. Approved sprinkler plans must be available on the project site during installation and inspection of the work.

3.3 Installation General:

- A. All holes made by the Contractor in any wall, ceiling or floor shall be patched by the Contractor, restoring the wall, ceiling or floor to its original condition, fire resistance and integrity.
- B. Removal and repair of all finished surfaces shall be coordinated with the Architect and subject to his/her approval.
- C. Location of all equipment, controls, piping, valves and drain shall be subject to Architect/Owner approval.
- D. Standard metal signs shall be provided in accordance with NFPA-13.
- E. All sprinklers and equipment shall be installed in accordance with manufacturer's instructions. All special tools recommended by the manufacturer shall be used.

3.4 Installation Piping and Sprinklers:

- A. Where sprinkler piping is installed in finished areas, the Contractor shall install all new piping so that it is concealed above finished ceilings, provide a minimum separation of 12" between the ceiling height and the bottom of the sprinkler pipe. Pipe installed in unfinished areas may be exposed.
- B. All exposed pipe which passes through a wall, ceiling, or floor shall be provided with escutcheon plates.
- C. All piping shall be installed so as not to obstruct any portion of a window, doorway, stairway or passageway, and shall not interfere with the operation or accessibility of any mechanical, plumbing or electrical equipment. Run piping horizontally and at right angles to walls and ceilings or along slope of ceilings.
- D. Center sprinklers in both horizontal directions with respect to ceiling components, such as ceiling grid (in center tile of 2'-0" direction and at quarterpoints of 4'-0" direction), light fixtures, HVAC diffusers, speakers and detectors as required.

- E. All sprinkler piping, drain and test piping, etc. installed through exterior walls shall be galvanized and have a 4'-0" minimum length to first valve located inside insulated building envelope.
- F. All sprinkler piping must be substantially supported from building structure and only approved type hangers shall be used. Sprinkler lines under ducts shall not be supported from ductwork, but shall be supported from building structure with trapeze hangers where necessary, in accordance with NFPA-13. Tapping or drilling of structural elements is not permitted. Use beam clamps or hang from top chord of joist. Do not hang from bottom chord of joist.
- G. Pendent sprinklers shall be in alignment with, and parallel to ceiling fixtures, walls, etc.
- H. Install sprinkler piping in exposed areas as high as possible using necessary fittings and auxiliary drains to maintain maximum clear head room, and to keep space aesthetically acceptable to Architect/Owner.
- I. Sprinklers shall be installed per the requirements of NFPA 13 with regard to ducts, obstructions, steel beams and joists, partitions, and ceiling projections. Provide additional sprinklers as required.
- J. Provide sprinkler protection below any ducts, banks of piping, etc., greater than 48" in width in all sprinklered areas.
- K. Contractor shall provide complete sprinkler protection before combustible contents are moved into the building.
- L. All sprinkler piping and fittings shall be so installed such that system may be drained. System shall primarily be designed to drain through main drain at riser(s).
- M. Minimum and maximum deflector distances shall be per NFPA requirements. A minimum of 18-inches from deflector to top of storage shall be provided.
- N. A minimum distance between sprinklers, as required by NFPA and the individual sprinkler U.L. listing or F.M. approval, shall be provided to avoid cold soldering of sprinklers.
- O. Provide fire protection during construction as required by local Authorities having jurisdiction.

3.5 System Drains:

- A. Provide 2" main drain valves at system control valves and extend piping to outside building. Provide a 4'-0" minimum length of main drain piping from exterior wall penetration to angle valve.
- B. Provide all auxiliary drains where necessary, extend and terminate at safe location.
- C. Provide 1/2" minimum pressure relief valve and drains on each riser supplying a gridded system.
- D. Pipe all drains to a location where water drained will not damage stock, equipment, vehicles, planted areas, etc., injure personnel, or patrons, or cause an unsightly wet area in front of any entrances.
- E. Plugs used for auxiliary drains shall be brass.
- F. Pressure relief and main drains shall not be interconnected.

3.6 Ceiling and Wall Plates:

- A. Install chrome wall plates wherever exposed sprinkler piping passes throughout ceiling and walls.

3.7 Sleeves:

- A. Set sleeves securely in place for all pipes passing through floor and masonry wall openings.
- B. Space between sleeve and pipe shall be filled with packing commensurate with construction. Provide chrome wall plates at each side of wall.
- C. Sleeves and seals through floors and exterior wall shall be watertight.
- D. All sleeves shall meet requirements of all Authorities having jurisdiction and Owner.

3.8 Inspector's Test:

- A. Provide inspector's test connections as specified in NFPA-13. Discharge orifice shall have same size orifice as smallest orifice of any sprinklers installed.
- B. Provide 1" site glass where inspector's test discharge cannot be readily observed while operating valve.
- C. Pipe all inspector's test connection discharges to atmosphere at location where water drain will not damage stock, equipment, vehicles, planted areas, etc., injure personnel, or patrons, or cause an unsightly wet area in front of any entrance.
- D. All pipe and fittings downstream of inspector's test valve shall be galvanized.

3.9 Sprinkler Guards and Water Shields:

- A. Provide guards for sprinklers within 7 feet of finish floor or wherever sprinklers may be subject to mechanical damage.
- B. Sprinklers located under open gratings, stairways, or in racks, shall be provided with shields and wire sprinkler guards.

3.10 Welding and Flame Cutting:

- A. No welding or flame cutting by the Contractor shall be permitted on the premises.
- B. Shop welding (off-site) shall meet all NFPA-13 and related requirements. Retrieve all discs from piping prior to site delivery.

3.11 Final Inspection and Tests:

- A. Overhead sprinkler piping: Tested for a period of two hours at a hydrostatic pressure of 200 lbs. and all piping, valves, sprinklers, etc., shall be watertight.
- B. Underground piping: Tested (by Utility Contractor) for a period of two hours at a hydrostatic pressure of 200 lbs. in accordance with NFPA Standards. Leakage shall not exceed quantities indicated. Coordinate with Utility Contractor to ensure proper testing and test schedule.

- C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion(s) of the system.
- D. All underground piping shall be thoroughly flushed (by Utility Contractor) in accordance with the requirements of NFPA Standards, prior to connection to overhead piping system. The flush test must be witnessed by all Authorities having jurisdiction. A test shall be made before the trench in which pipe is laid is backfilled. Coordinate with Utility Contractor to ensure proper testing and test schedule.
- E. The Contractor shall make arrangements with all Authorities have jurisdiction for final inspection and witnessing of the final acceptance tests.
- F. If, when the Owner's consultant or any other Authorities having jurisdiction visit the job site for this purpose after being advised by the Contractor that the work is completed and ready for test, the work has not been completed, or the final acceptance tests are unsatisfactory, the Contractor shall be responsible for Consultant's extra time and expenses for reinspection and witnessing the retesting of the work. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- G. Contractor shall provide at least (5) working days notice to Architect and Owner via General Contractor for all tests and field observations.
- H. Flushing of all piping shall be conducted with water flowing at a minimum velocity of 10 feet per second.

END OF SECTION

SECTION 21 13 00 - FIRE ALARM SPECIFICATION

1.01 GENERAL REQUIREMENTS

- A. The requirements of the Contract Documents, including the General and Supplementary General Condition and Division 1 - General Requirements shall apply to the work of this section.
- B. Prior to the bid the Contractor shall list all exceptions, variances, and proposed substitutions to these Specifications and forward the list to the engineer. Any such exceptions, variances or substitutions that were not forwarded to the engineer prior to the bid shall be grounds for immediate disapproval without comment. Final determination of compliance with these Specifications shall rest with the engineer, who, at his discretion, may require proof of performance.
- C. This specification outlines minimum operational capacities of a fire alarm system. If conditions do not permit these operational characteristics please contact the architect of record.

1.02 RELATED WORK

Division 16 – Electrical
Section 13910 – Sprinklers
Division 15 – HVAC Systems

1.03 SCOPE & RESPONSIBILITIES

- A. This section of the specification includes the provision and installation of a Fire Alarm/Life Safety System as required. The system shall be complete per state any and all local and national codes, The National Electric Code and NFPA 72.
- B. The Contractor shall provide all labor, equipment, materials and services to furnish and install all required fire alarm equipment, devices, power supplies, remote panels, etc. to provide a complete fire alarm system as described on the FA drawings and as acceptable to the Authority Having Jurisdiction (AHJ). It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. This installation will reflect the Contractor's shop drawing(s) as much as practically possible.
- C. In the Contractor's bid shall be a separate line item(s) for a one year, a three year, and a five year system maintenance and testing agreement. All such testing is to be in compliance with the requirements of NFPA 72.
- D. In the Contractor's bid shall be a separate line item for an After Warranty Service Rate to be in effect for a minimum of five years.
- E. The Contractor is responsible for contracting and scheduling the work for the project. The Contractor shall contact the designated Owner's Representative, not less than two (2) weeks in advance, to coordinate a construction schedule and verify any access requirements and/or limitations. After hour work hours may be required for this remodel. Please coordinate with the warehouse management, architect, and AHJ.
- F. The contractor shall contact the architect of record with any comments, exceptions, and/or reservations to the drawings and specification prior to bid. By not identifying any differences prior to bid, the contractor is not entitled to any additional money.

- G. All necessary conduit, boxes (unless otherwise indicated), fittings, couplings, connectors, straps, supports, pull-lines, bushings. etc. shall be provided by the Contractor.
- H. The Contractor shall provide all line voltage (120 V. max.) and low-voltage (up to 50 VAC/VDC) circuiting in separate conduit. Low-voltage circuiting may be run exposed if permitted by the local AHJ.
- I. An NFPA 72 Record of Completion shall be prepared by the contractor and submitted to Owner's Representative upon the completion of the project and prior to the AHJ acceptance test. Any item that is identified in this report shall be corrected and the system shall be fully operable prior to the date of the final building Certificate of Occupancy Inspection.
- J. This section of the specification includes the provision and installation of a Fire Alarm/Life Safety System as required. The system shall be complete per national, state, and any local codes and ordinances, The National Electric Code and NFPA 72
- I. Please contact Hunter Design Group if there are any questions regarding the fire alarm system scope or system questions: 206-780-8426

1.04 QUALITY ASSURANCE

A. Manufacturer

- 1. The system and components shall be supplied by one of the following manufacturers; Firelite, Silent Knight, Notifier, Edwards System Technologies (EST), Autocall, Gamewell, Honeywell, or any approved equal.
- 2. The equipment described in this section represents the function and type of some of the materials required and herein specified. The equipment indicated in this section is not intended to be a complete list of all components required for an operational and approved system. This serves only as guidelines from which the system should be designed around. Additional equipment not herein specifically indicated but are a necessary part of an operational and approved system shall be provided as required.

B. Qualification of Distributor/Supplier/Installer

- 1. The fire alarm system contractor shall hold a Fire Alarm Contractor license, as required by the State and local jurisdiction.
- 2. The fire alarm system contractor shall employ a Nicet certified level III (minimum) technician that shall be responsible for project supervision and final system programming, testing, and turnover.
- 3. The installing contractor shall be well versed in fire alarm systems with at least 5 years of experience installing same.

C. Submittals

- 1. The Contractor shall submit five (5) sets of shop drawings that shall contain the following information as related to the proposed work through the architect. Incomplete submissions will be rejected. The shop drawings shall include the following as a minimum:

Surprise, AZ

- a. Product data sheets.
- b. Scaled building floor plan(s) indicating location and type of devices, device addresses, conduit and/or wire routing, wire quantities, and junction points.
- c. Job specific riser diagram indicating components, devices, conductors, conductor sizes, and end-of-line resistors.
- d. Device connection details.
- e. Back up battery calculations for each system. A separate battery calculation shall be submitted for each remote panel.
- f. Notification Appliance Circuit load calculations and voltage drop calculations indicating voltage at each device. The Fire Alarm contractor shall provide line voltage drop calculations that shall demonstrate that the voltage supplied at all indicating appliances is above the UL specified minimum for the indicating appliances employed. The Fire Alarm contractor shall provide sufficient quantities of 24 VDC power supplies, in the proper locations, to insure that the UL specified minimum voltage is present at all indicating appliances.
- g. Project specific Sequence of Operation.
- h. Proposed device nomenclature.
- i. Proposed programming inputs/outputs.
- j. Fire alarm submittals shall be in compliance with the standard plan review format as provided by NFPA 72.

D. Equipment Handling

1. The Contractor shall deliver each piece of equipment in durable shipping cartons of manufacturer's label. Damaged cartons shall not be accepted. Maintain cartons throughout contractor transport, storage, and handling undamaged and free of dirt, paint, chemicals, water or moisture.

E. Applicable Installation Codes and Standards

1. NFPA 72 National Fire Alarm Code
2. The National Electric Code.
3. Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)),
4. All other national and local building and fire codes and authorities having jurisdiction.
5. The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:

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UL 864/UOJZ, APOU, UUKL Control Units for Fire Protective Signaling Systems.

UL 268 Smoke Detectors for Fire Protective Signaling Systems.

UL UL268A Smoke Detectors for Duct Applications.

UL 228 Door Closures-Holders for Fire Protective Signaling Systems.

UL 464 Audible Signaling Appliances.

UL 1971 Visual Signaling Appliances.

UL 38 Manually Actuated Signaling Boxes.

UL 346 Water flow Indicators for Fire Protective Signaling Systems.

UL 1481 Power supplies for Fire Protective Signaling Systems.

UL 521 Heat Detectors for Fire Protective Signaling Systems.

F. Related Documents

1. Contractor shall secure all necessary local and state permits and approvals prior to any installation work being performed.
2. A copy of all necessary permits must be posted at the project site during the course of construction.
3. An NFPA 72 Record of Completion shall be prepared by the Fire Alarm Contractor commissioning technician and submitted to the Owner upon the completion of the project and prior to the AHJ acceptance test. The Record of Completion shall contain the technician's name and signature.

G. RELATED WORK

1. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include (if required), but not be limited to:
 - a. Sprinkler waterflow switches, control valve supervisory switches, and low air supervisory switches (if applicable) shall be furnished and installed by the fire sprinkler contractor. The Fire Alarm Installing Contractor shall be responsible for piping to a junction box, install wire, and provide flexible raceway to the final termination at the device. Monitoring circuits shall be provided by the Fire Alarm contractor.
 - b. Duct smoke detectors shall be provided by the Fire Alarm contractor. The Fire Alarm Installing Contractor shall be responsible for all raceway and wiring to the detector and the remote test station, and from the control relay to the respective HVAC starter control center and terminations. The duct smoke housing and sampling tubes shall be installed by the mechanical contractor. The duct smoke detector shall be installed by the Fire Alarm Contractor.

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- c. All raceway and wiring from the fire alarm control panel to the Fire Pump (If applicable) shall be provided by the Fire Alarm Installing Contractor. The Fire Pump control equipment contacts shall be provided by the Fire Pump Supplier. All final connections shall be coordinated by Fire Alarm and Fire Pump Control Installation Contractors.

H. Warranty

1. The Fire Alarm contractor shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system.
2. The Installing Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

1.05 SYSTEM OPERATION

- A. This is a specification which outlines minimum operational capacities of a fire alarm system. All additions, retrofits, and renovations of the fire alarm system shall be expected to meet this criterion.

B. GENERAL

When required, the system shall consist of, but not be limited to, the following:

1. Fire alarm control panel.
2. Remote Annunciator (built-into FACP is preferred method).
4. Manual fire alarm pull stations.
5. Area smoke detectors.
6. Duct smoke detectors.
7. Heat detectors.
8. Sprinkler waterflow alarm switches.
9. Remote auxiliary power supplies.
10. Audible notification appliances; bells, horns
11. Visual notification appliances; strobes
12. Central station alarm connection control/autodialer
13. Smoke control/smoke purge interface/Air handling systems shutdown control where required.
14. Emergency Generator supervision.
15. Fire Pump supervision (if applicable).

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16. Sprinkler supervisory switches and tamper switch supervision.
17. Battery standby.

C. SEQUENCE OF EVENTS

1. An alarm condition shall initiate the following sequence:
 - a. The alarm condition shall be visually and audibly indicated at the FACP as follows:
 1. Illuminate a red "system fire alarm" LED indicator. The indicator shall flash until the system is silenced. After the system is silenced, the LED shall change from flashing to steady and remain illuminated until the system is reset.
 2. Continuously sound an audible buzzer at the FACP that shall sound until the system is silenced.
 3. Display specific information about the alarm condition on the LCD as follows;
 - a. Type of event.
 - b. Time of event.
 - c. Numeric identification of point in alarm.
 - d. 20 character text message unique to the specific point in alarm.
 - e. An indication of the number of outstanding events in the system.
 - b. Sound a synchronized and/or voice evacuation signal as required by local authority having jurisdiction and NFPA 72 Standards.
 - c. Activate synchronized visual alarm strobes in the same areas in which audible signals are activated.
 - d. Activate the digital communicator to the central station service.
 - e. The system shall direct the HVAC system fans, dampers, and other equipment as indicated in the construction plans and attached schedules and in accordance with relevant local, state and national codes and standards.
 - f. Actuate the panel's common alarm contacts.
 - g. Release all magnetically held open doors.
 - h. Unlock all electrically locked doors as required by the AHJ.

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- i. Upon operation of system silence, audible signals shall silence while visual signals shall continue to operate until the system is reset.
2. Activation of any supervisory device shall initiate the following system supervisory response(s);
 - a. The supervisory condition shall be visually and audibly indicated at the FACP as follows:
 1. Illuminate a yellow "system supervisory" LED indicator. The indicator shall flash until the system is silenced. After the system is silenced, the LED shall change from flashing to steady and remain illuminated until the system is reset.
 2. Continuously sound an audible buzzer at the FACP that shall sound until the system is silenced.
 3. Display specific information about the supervisory condition on the LCD as follows;
 - a. Type of event.
 - b. Time of event.
 - c. Numeric identification of point in alarm.
 - d. 20 character text message unique to the specific point in alarm.
 - e. An indication of the number of outstanding events in the system.
 - b. Activate the digital communicator to report a supervisory report to the central station service.
 - c. Actuate the panel's common supervisory contacts.
 3. Any trouble condition shall initiate the following system trouble response(s);
 - a. The trouble condition shall be visually and audibly indicated at the FACP as follows:
 1. Illuminate a yellow "system trouble" LED indicator. The indicator shall flash until the system is silenced. After the system is silenced, the LED shall change from flashing to steady and remain illuminated until the condition is corrected.
 2. Continuously sound an audible buzzer at the FACP that shall sound until the system is silenced.
 3. Display specific information about the trouble condition on the LCD as follows;
 - a. Type of event

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- b. Time of event
 - c. Numeric identification of point in alarm
 - d. 20 character text message unique to the specific point in alarm
 - e. An indication of the number of outstanding events in the system.
- b. Activate the digital communicator to send a trouble report to the central station service.
 - c. Actuate the panel's common trouble contacts.
 - d. All trouble sequences will automatically revert to normal status and condition upon correction of the trouble condition.

1.06 SYSTEM CIRCUITING

- A. All system circuiting shall be as follows:
 - 1. All circuits (SLC, IDC, and NAC) shall be Class A per NFPA 72, local and state requirements.

PART 2 - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL

- A. The fire alarm control panel shall be fully UL listed for fire alarm use. Please note that hard-wired 'zoned' systems are acceptable if by AHJ and if the point-count is such that a zoned system has sufficient capacity for all initiating devices. Analog technology with drift compensation shall be required and provided if full smoke detection is required. The minimum performance standards for an addressable fire alarm system are:
 - 1. All control electronics, relays, and necessary modules and components housed in a surface mounted cabinet. The cabinet shall be capable of adapting a flush or semi-flush trim ring.
 - 2. The cabinet shall be 16 GA. steel, with a permanent finish.
 - 3. The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window.
 - 4. The CPU shall perform automatic Daylight Savings Time adjustments.
 - 5. The system shall store all job specific data in non-volatile memory. The data shall survive a complete power failure intact.
 - 6. The system shall allow uploading and downloading of job specific application program

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7. The system shall have built-in automatic system programming to automatically address and map all system devices and provide a minimum default single stage alarm system operation with support of alarm silence, trouble silence, drill, lamp test, and reset common controls.
8. The system shall have an event history log of at least 200 events.
9. The system shall be field programmable.
10. The fire alarm control panel shall have minimum of two notification appliance circuits, 2 amps each, and capable of separately programming each circuit to be silenceable or non-silenceable.
11. Notification appliance circuits shall be capable of Style Y and/or Z.
12. Addressable circuits shall be capable of Style 4, 6 or 7 configuration.
13. The system shall support T taps on SLC.
14. The system shall support 100% of all devices on all SLC's to be active at the same time and provide support for a 100% compliment of detector isolator bases.
15. The system shall support grouping or zoning of all input and/or output devices.
16. It shall be possible to disable a device from the annunciator. It shall be possible to disable a group, or zone, of devices with one command and without having to call up each device.
17. The system shall be capable of setting alarm verification for any or all smoke sensors.
18. NA.
19. NA.
20. The system shall have a U. L. listed detector sensitivity test feature.
21. The system shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
22. Addressable monitor modules' initiating device circuits shall be capable of Style B and/or D.
23. The system shall feature a true one man walk test.
24. The system shall support multiple remote point driver modules.
25. The system shall provide summary printouts the following, as a minimum:
 - a. values of all points
 - b. event history log

26. In the event of main processor failure, the FACP shall operate in default general alarm mode.
27. The FACP shall be complete with back up batteries for twenty four hours of standby condition and five minutes of alarm condition.

2.02 REMOTE AUXILIARY POWER SUPPLY

- A. Provide where required a switching power supply that provides auxiliary 24 VDC power.
 1. Brownout and loss of AC power shall cause automatic changeover to connected standby battery supply sized to provide for the attached load in accordance with control equipment specifications.
 2. AC line, battery condition and output wiring ground faults shall be monitored by the power supply and signaled to the FACP via the signaling line circuit. A Ground Fault LED shall be provided on the power supply unit. Battery condition monitoring shall include low voltage, missing batteries, reverse connection and shorted battery connection. Reverse and shorted battery connections shall not damage the power supply.
 3. The power supply assembly shall consist of the power supply/battery charger mounted within a dedicated and locked enclosure designed for surface wall mounting.
- B. Shall be complete with back up batteries for twenty four hours of standby condition and five minutes of alarm condition

2.03 REMOTE ANNUNCIATOR(S)

- A. Remote Annunciator
 1. Remote Annunciator shall be capable of either surface or flush mounting.
 2. Remote Annunciator shall be able to be located anywhere throughout the facility.
 3. Annunciator switches may be programmed for system control such as, local or global acknowledge, local or global signal silence, local or global system reset
 3. The Annunciator shall display all alarm and trouble conditions in the system.
 4. The Annunciator shall display LCD readout of all system conditions.

2.04 FIRE ALARM NOTIFICATION APPLIANCES

- A. Horns and Strobes
 1. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessabilities Guidelines (ADA(AG)), and shall be UL 1971, UL 1638, and ULC S526 Listed.
 2. Horns and strobes shall operate on 24 VDC nominal.

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3. All strobes on a circuit shall be synchronized.
4. Devices shall be mounted per the National Electric code, NFPA 72, local and state requirements.
5. Outdoor devices shall be mounted on cast weatherproof outlet boxes.
6. Horns shall be temporal pattern code 3.

B. Speakers:

1. Compliance: UL 1480.
2. Operate on 25 or 70 VRMS or with field-selectable output taps from 0.25 to 2.0 watts.
3. Speakers in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet, at one watt tap setting.
4. Frequency Response: Minimum of 400 Hz to 4,000 Hz.
5. Back of Each Speaker: Sealed to protect speaker cone from damage and dust.

2.05 INITIATING DEVICES, EQUIPMENT, AND FIELD MODULES

A. Addressable Smoke Sensors

1. All addressable smoke sensors shall operate on a photo-electric principal unless otherwise noted.
2. Shall provide LED. The LED shall flash under normal conditions and shall illuminate steady for an alarm condition.
3. Detectors shall feature automatic drift compensation.
4. The detectors shall be ceiling-mount and shall include a separate twist-lock base.
5. Sensors shall transmit an analog value to the FACP based on real-time measured values.

B. Addressable Heat Sensors

1. Fixed Temperature/Rate-of-Rise Heat sensor shall operate at a nominal fixed temperature of 135°F and at a temperature rise at or exceeding 15°F per minute.
2. The sensor shall have an LED. The LED shall flash under normal conditions and shall illuminate steady for an alarm condition.

C. Bases

1. Sensor bases shall mount to standard 3.5" or 4" octagon or 4" square boxes.

2. Removal of the respective sensor shall not affect communications with other detectors.

D. Addressable Duct Smoke Detectors

1. Provide addressable air duct photo-electric smoke sensors and integral twist-lock bases as required. Air duct smoke sensors shall utilize same detector head as ceiling mounted photo-electric detector
2. It shall be U. L. listed for duct mounting.
3. Shall be same head as open area sensor.
4. Shall contain minimum 1 set form C contacts.
5. Contacts shall be for pilot relay use only.
6. The sampling tubes must be installed per NFPA standards.

E. Addressable Pull Station

1. Addressable pull stations shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. Shall be red. The word FIRE shall be in raised white letters.
3. Manual stations shall be constructed of Lexan (as a minimum) with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters.
4. Stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

F. Addressable Monitor Module

1. Addressable monitor modules shall be provided to connect interface any N.O. dry contact device to one of the fire alarm control panel SLC loops.
2. The IDC zone may be wired for Style D or style B operation per jurisdictional requirements. An LED shall be provided that shall flash under normal conditions and illuminate steady under alarm conditions.

G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of auxiliary devices. The control module shall have form C contacts.
2. The control module shall be used as a pilot relay only if the controlled device/circuit is in excess of 24 vdc.

H Air Handler Shut Down Relay/Smoke Control Relay

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1. Shall be a voltage controllable by an addressable control module.
 2. Shall be mounted within a dedicated enclosure for surface wall mounting within 3' of the controlled device.
- I. Isolator Module
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. One isolator module shall be provided for each T-tapped branch circuit.
 2. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
 3. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation of the fire alarm system shall be in strict compliance with manufacturer's recommendations. Consult the manufacturers control panel and peripheral equipment installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation.
- B. Fastening and supports of all equipment shall be adequate to support the required load and provide a safety factor of 5.
- C. Each system alarm point or zone in the system shall be uniquely labeled within the fire alarm control panel.
- D. All device activation shall be indicated individually on a separate zone in the fire alarm control panel.

3.02 CABLE AND WIRING

- A. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the emergency panel and within the fire alarm control panel enclosure as "**FIRE ALARM CIRCUIT CONTROL**" and the circuit breaker shall be effectively locked out with an approved, listed breaker lock device provided and installed by electrical contractor. The control panel cabinet shall be grounded securely per manufacturers requirements. Conduit shall enter into the fire alarm control panel only at those areas of the backbox that have factory conduit knockouts.
- B. Provide all line voltage (120 V. max.) and low-voltage (up to 50 VAC/VDC) circuiting in separate conduit.
- C. Branch wiring from control and monitor modules to controlled and monitored points shall be as per manufacturer's recommendations.
- D. All wire terminations shall be stripped, landed, and devices installed by the alarm contractor. The alarm contractor will provide not less than 12" slack wire at devices and 6'-0" slack wire

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at the control panel for final termination by alarm contractor.

- E. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

3.03 CONDUITS AND BOXES

- A. All junction boxes shall be labeled as "fire alarm system" with approved markings.
- B. All devices shall be provided a separate, independently mounted, UL listed back box.

3.04 IDENTIFICATION

- A. The Fire Alarm Installing Contractor shall permanently number code cables/conductors, as indicated on the shop drawings.

3.05 FINAL SYSTEM ACCEPTANCE

- A. The system will be accepted only after a satisfactory test of the entire system has been accomplished by the installing contractor and the AHJ. An NFPA 72 Record of Completion shall be prepared by the commissioning technician and shall be submitted to the Owner's Representative upon the completion of the project and prior to the AHJ acceptance test. The Record of Completion should contain the technician's name and signature.
- B. Final acceptance will require the installing contractor to deliver to the owner the following close out documents:
 - 1. Three (3) copies of the operating instructions and system maintenance manuals.
 - 2. Three (3) sets of record drawings (as built drawings).
 - 3. Three (3) copies of print out of the system application software.
 - 4. Three (3) copies of the final test reports and Record of Completion.
 - 5. Three (3) copies indicating the name and phone number of person to contact in the event of equipment failure, and date when system warranty will terminate.
- C. The Fire Alarm System Contractor shall provide the owner demonstration on the operation and features of the fire alarm system.

3.06 WARRANTY

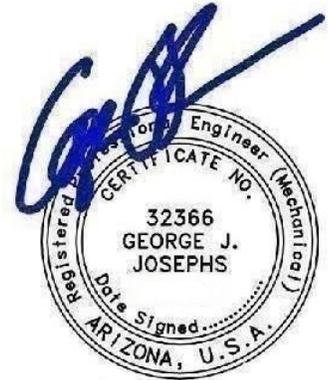
- A. The fire alarm system shall be warranted for a period of one year from date of acceptance by the AHJ. The warranty shall cover parts, labor and travel to and from site.

END OF SECTION

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SECTION 22 00 00

PLUMBING



PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. General Requirements of Plumbing Contractor:

1. Provide all labor, materials, equipment and services necessary for complete and operable installation of the Plumbing system in conformity with requirements of all Authorities having jurisdiction as indicated in the Contract Documents.
2. All Architectural drawings and specifications, fixture specifications, general, special and supplementary conditions, shall be considered a part of these specifications.
3. Prior to submitting bid, become thoroughly familiar with actual existing conditions and of the present installations to which connections must be made or which must be changed or altered. The intent of the work is shown on the drawings and described herein, and no consideration will be granted by reason of lack of familiarity on the part of the Contractor with actual physical conditions, requirements, and practices at the site.
4. Carefully check the documents of other sections to determine the requirements of any related work furnished and/or installed by that section. Provide the proper installation and/or connection.
5. Keep site free from surplus material, tools and rubbish at all times during construction period and, upon completion, leave site in clean condition.
6. Protect materials and equipment from all damage due to fire, theft, vandalism, weather, etc.
7. Repair any damage, at no extra cost to the Owner, caused to work of other sections.
8. Repair any damaged fireproofing, at no extra cost to the Owner, caused to integrity of original construction.
9. Contractor agrees that he and his subcontractors, agents, and employees will provide and maintain a safe place to work and that he and they will comply with all laws and regulations of any governmental authority having jurisdiction thereof. The Contractor agrees to indemnify, defend and hold harmless, Engineer, Owner and Architect from and against any liability, loss, damage or expense, including attorney's fees, arising from a failure or alleged failure on the part of Contractor, his and their agents,

and employees to provide and maintain a safe place to work or to comply with all laws and regulations of any governmental authority having jurisdiction thereof.

10. Transmit all information required for work being performed by other sections in ample time for the proper installation and connection, and for the provision of all openings required in floors and walls.
11. Field drilling and cutting of holes in building structure required for work under this section shall be coordinated through the General Contractor and approved by Owner and Building Structural Engineer. Contractor shall bear all costs for such coordination, drilling, cutting and reinforcing costs.
12. Furnish and set all sleeves for the passage of piping through walls, roof and floors and elsewhere as will be required for the proper protection of each pipe passing through building surfaces. Coordinate this work with the General Contractor in order to properly expedite and perform this work.
13. Check the dimensional requirements of equipment to ensure that equipment can pass through the necessary areas to reach the location for installation. Include in bid costs for all work required, including any work required to move the equipment through the site to this final location.
14. Provide equipment tags per codes and authorities having jurisdiction.
15. Notify the General Contractor and Engineer in writing, within five days of award of contract, of the proposed delivery schedule of any equipment or material that may prevent the installation from being completed by the project completion date.
16. Submit a single guarantee stating that all portions of the work are in accordance with contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one year from date of final acceptance by Owner. Where guarantees or warranties for longer terms are specified by contract, such longer term shall apply.
17. Correct any deficiencies that may occur during the guarantee period, all to the satisfaction of the Owner, at no additional cost to the Owner within a reasonable time period. The Contractor shall be responsible for any damage caused by such deficiencies and repair thereof and reimburse the Owner for all costs incurred.
18. Carefully coordinate piping in walls with electrical contractor and mechanical contractor for locations of all piping, conduits and ductwork.

B. Major Items of Work include:

1. Domestic hot water, cold water and hot water return distribution systems including all pipe, valves, piping offsets, fittings, unions, inserts, hangers and connections to existing work.
2. Thermal insulation of hot water and hot water return piping.

3. Sanitary waste and vent system including all pipe, piping offsets, connections, flanges, and connections to existing work.
4. Storm water system including all pipe, piping offsets, fittings, hangers, inserts and connections to existing work.
5. Natural gas piping.
6. Plumbing fixtures, drains, equipment and specialties.
7. Pumps.
8. Vibration Isolation.
9. Controls.
10. Testing and balancing of all systems.

C. General Items:

1. Access Doors Panels: Provide concealed controls, valves and equipment requiring access with adequately sized access doors/panels. In removable type ceiling, provide access tile identification only.
2. Cutting and patching for plumbing work.
3. Coordinate all new work with existing installations.

1.02 REFERENCES

A. Published specifications, standards, tests or recommended methods of trade industry or governmental organizations apply to work in this section where cited below:

1. Local Codes
2. State Codes
3. IPC-International Plumbing Code
4. ASME-American Society of Mechanical Engineers
5. UL-Underwriters' Laboratory
6. AGA-American Gas Association
7. ICBO-International Conference of Building Officials
8. IAPMO-International Association of Plumbing and Mechanical Officials

1.03 SUBMITTALS

A. Submit the following to Architect:

Manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

- B. All equipment and accessories shall be the product of a company regularly engaged in the manufacture of that product for at least five years.
- C. All equipment and accessories shall be new and free from defects.
- D. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.02 of this section and with all applicable national, state and local codes.
- E. All items of a given type shall be the products of the same manufacturer.

1.04 DESCRIPTION OF CONTRACT DOCUMENTS

A. Specifications:

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as "The Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" etc. may be omitted for brevity.

B. Drawings:

1. Drawings in general are diagrammatic and indicate scope, sizes, routing, locations, connections to equipment and methods of installation. The Drawings do not necessarily show all required offsets, obstructions or structural conditions. Locations on drawings may be distorted for purposes of clearness and legibility.
2. Scaled and figured dimensions are approximate and are for estimating purposes only, but shall be followed with sufficient accuracy to coordinate with other work and structural limitations. **DO NOT SCALE DRAWINGS.**
3. Before proceeding with work, check and verify all dimensions and carefully check space requirements with other Work to ensure that all equipment and materials can be installed in spaces allotted.
4. The Contractor shall assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. The Contractor is responsible for installing the work in such a manner that it will conform to the structure and architectural elements, avoid obstructions, maintain headroom, leave adequate clearance for proper maintenance and repairs, and provide clearances and access required by codes.
6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

7. Above items to be performed at no additional cost to the Owner.

- C. Immediately and formally notify the Architect requesting his interpretation and decision, including during bidding period, if any part of the Contract Documents appears unclear or contradictory. Do not proceed with such work without Architect's decision.
- D. At all locations where piping is installed in masonry walls: coordinate piping locations with rebar and structural reinforcing. Metal piping installed in masonry walls shall be protected with a listed wrap. Plastic piping installed in masonry walls shall have clearance between piping and masonry cells.

1.05 PERMITS AND INSPECTIONS

- A. The contractor shall secure all approvals and pay all fees for all work installed. Certificate shall be delivered to owner before final payment will be made.

1.06 PROJECT CONDITIONS NOT USED.

1.07 QUALITY ASSURANCE

- A. Materials shall be new and free from defects and listed by Underwriters' Laboratories, Inc., (or other approved testing and listing agency) or bearing their label. Conform to codes, standards and publications listed in paragraph 1.02 References.

1.08 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.
- B. Handle and ship in accordance with manufacturer's recommendations.
- C. Provide protective coverings during construction.
- D. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Architect.
- E. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.
- F. Include packing and shipping lists.
- G. Accessibility:

1. For operation, maintenance and repair.
2. Minor deviations are permissible.
3. Changes of magnitude or involving extra cost are not permissible without review.
4. Group concealed mechanical equipment requiring access with equipment freely accessible through access doors.

1.09 SUBMITTALS

- A. Provide six (6) copies of submittal material with descriptive data for all products and materials prior to purchase and installation, including but not limited to the following:
1. Water heaters.
 2. Insulation.
 3. Piping materials
 4. Piping accessories.
 5. Pumps.
 6. Expansion tanks.
 7. Drains.
 8. Fixtures.
 9. Controls.
 10. Vibration isolation.

1.10 MAINTENANCE MANUALS AND RECORD DRAWINGS

- A. Provide four (4) copies of operating and maintenance manual for Owner's use for each piece of equipment. Each item shall be cross-referenced and numbered with as-built drawing descriptions.
- B. Deliver to Owner, one set of mylar sepias and one bound set of blueprints and panel schedules showing work as actually installed. Label drawings "RECORD DRAWINGS."

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plumbing Fixtures:
1. American Standard
 2. Kohler
 3. Prior Approved Equivalants
- B. Faucets

1. American Standard
2. Kohler
3. Chicago

C. Gas Water Heaters

1. Lochinvar
2. A.O. Smith
3. P.V.I

D. Valves

1. Stockham
2. Nibco
3. Milwaukee

2.02 MATERIALS

A. Domestic Water

1. Pipe:

- a. Seamless copper tubing, type L, cold drawn, hard temper, ASTM B88 for all plumbing risers and public mains and PEX or other Code approved plastic piping only in living area corridors.
- b. Exposed to view at plumbing fixtures, satin finish CP brass pipe with threaded cast bronze fittings.

2. Fittings:

- a. Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18.

3. Control Valves:

- a. 125 PSI WWP, bronze non rising stem gate type.
- b. Threaded ends similar to Stockham B-103.
- c. Solder joint type ends, similar to Stockham B-104.

4. Insulation:

- a. All hot water and hot water return.

5. Testing and Disinfection:

- a. Pressure test in accordance with AHJ requirements.
 - b. Disinfect all hot and cold water systems.
- B. Soil, Waste and Vent (note: Plastic pipe will be approved with owner's approval).
- 1. Pipe:
 - a. 2 in. and larger: CISPI 301 standard weight cast iron no-hub type soil pipe.
 - b. 1-1/2 in. and smaller: Schedule 40 galvanized steel pipe.
 - c. Plastic pipe solid core pressure pipe PVC or ABS for all drain, waste, vent and rainwater piping. Note provide for expansion and contraction at roof drain piping connections and at penetrations through floors.
 - d. Foam Core Piping shall not be used on this project.
 - 2. Fittings:
 - a. 2 in. and larger CISPI 301 standard weight cast iron no-hub type soil fittings and neoprene gasket and stainless steel bands and shield, no-hub couplings.
 - b. 1-1/2 in. and smaller: galvanized cast iron drainage type screwed fittings.
 - c. PVC or ABS glued fittings, service weight with no-hub couplings where required for connection to metallic drain outlets.
- C. Rainwater and drainage System (note: Plastic pipe will be approved with owner's approval).
- 1. Pipe:
 - a. Piping below grade or slab-on-grade shall be service weight cast iron, no-hub pipe conforming to CISPI Standard 301-95 and ASTM Standard A-888.
 - b. Piping above slab on grade shall be either service weight cast iron, no-hub pipe conforming to CISPI Standard 301-95 and ASTM Standard A-888.
 - c. All piping service weight PVC or ABS with appropriate service weight glued fittings. Note: provide for expansion and contraction at roof drain connections. Foam Core Piping shall not be used on this project.

D. Natural Gas Piping:

1. Pipe:

a. Schedule 40, ASTM A53 or ANSI B16.3, black steel with 150 psi, malleable iron, banded thread fittings for 2" diameter and smaller, welded for larger than 2" diameter. Provide corrosion protection as required by code.

b. Extend gas line to all equipment and connections requiring gas. Provide gas pipe with suitable drip legs on all mains and risers, and at equipment connections. Provide AGA approved gas-rated valves at all equipment connections.

Fittings:

a. Unless otherwise specified, install fittings of the same material and finish as piping.

b. Pipe 1-1/2" and smaller, 150 psi black malleable iron conforming to ANSI B16.3, 150 psi SWP.

c. Pipe 2" and larger, black steel seamless welding fittings conforming to ANSI B16.9 and USAS B16.25, 150 psi SWP.

d. Unions: Black malleable iron, screwed connections, ground iron-to-bronze seat, conforming to ASTM A147, 250 psi SWP.

e. Flanges: Black forged steel with weld neck flanges, conforming to ANSI B16.5, 150 psi SWP.

E. Plumbing fixtures:

1. See Plumbing Plans.

PART 3 EXECUTION

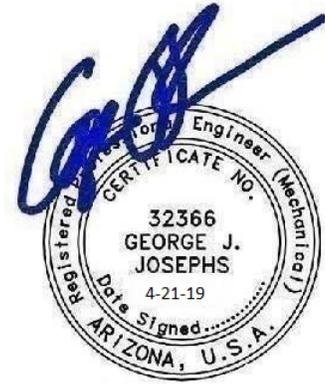
3.01 TESTS

A. In accordance with the requirements of AHJ.

END OF SECTION

SECTION 23 00 00

MECHANICAL



PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. General Requirements of Mechanical Contractor:

1. Provide all labor, materials, equipment and services necessary for complete and operable installation of the Heating, Ventilating, Air Conditioning (HVAC) system in conformity with requirements of all Authorities having jurisdiction as indicated in the Contract Documents.
2. All Architectural drawings and specifications, fixture specifications, general, special and supplementary conditions, shall be considered a part of these specifications.
3. Prior to submitting bid, become thoroughly familiar with actual existing conditions and of the present installations to which connections must be made or which must be changed or altered. The intent of the work is shown on the drawings and described herein, and no consideration will be granted by reason of lack of familiarity on the part of the Contractor with actual physical conditions, requirements, and practices at the site.
4. Carefully check the documents of other sections to determine the requirements of any related work furnished and/or installed by that section. Provide the proper installation and/or connection.
5. Keep site free from surplus material, tools and rubbish at all times during construction period and, upon completion, leave site in clean condition.
6. Protect materials and equipment from all damage due to fire, theft, vandalism, weather, etc.
7. Repair any damage, at no extra cost to the Owner, caused to work of other sections.
8. Repair any damaged fireproofing, at no extra cost to the Owner, caused to integrity of original construction.
9. Contractor agrees that he and his subcontractors, agents, and employees will provide and maintain a safe place to work and that he and they will comply with all laws and regulations of any governmental authority having jurisdiction thereof. The Contractor agrees to indemnify, defend and hold harmless, Engineer, Owner and Architect from and against any liability, loss, damage or expense, including attorney's fees, arising from a

failure or alleged failure on the part of Contractor, his and their agents, and employees to provide and maintain a safe place to work or to comply with all laws and regulations of any governmental authority having jurisdiction thereof.

10. Transmit all information required for work being performed by other sections in ample time for the proper installation and connection, and for the provision of all openings required in floors and walls.
11. Field drilling and cutting of holes in building structure required for work under this section shall be coordinated through the General Contractor and approved by Owner and Building Structural Engineer. Contractor shall bear all costs for such coordination, drilling, cutting and reinforcing costs.
12. Furnish and set all sleeves for the passage of piping through walls, roof and floors and elsewhere as will be required for the proper protection of each pipe passing through building surfaces. Coordinate this work with the General Contractor in order to properly expedite and perform this work.
13. Check the dimensional requirements of equipment to ensure that equipment can pass through the necessary areas to reach the location for installation. Include in bid costs for all work required, including any work required to move the equipment through the site to this final location.
14. Provide equipment tags per codes and authorities having jurisdiction.
15. Notify the Owner, Architect, General Contractor and Engineer in writing, within five days of award of contract, of the proposed delivery schedule of any equipment or material that may prevent the installation from being completed by the project completion date.
16. Submit a single guarantee stating that all portions of the work are in accordance with contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one year from date of final acceptance by Owner. Where guarantees or warranties for longer terms are specified by contract, such longer term shall apply. Provide (5) five-year compressor warranty for all air conditioning equipment.
17. Correct any deficiencies that may occur during the guarantee period, all to the satisfaction of the Owner, at no additional cost to the Owner within a reasonable time period. The Contractor shall be responsible for any damage caused by such deficiencies and repair thereof and reimburse the Owner for all costs incurred.

B. Major Items of Work include:

1. Air conditioning systems: Supply, return and exhaust air distribution systems, including equipment, ductwork, supply air diffusers, return air grilles, exhaust air registers, controls and connections to existing work.
2. Thermal and acoustical insulation.
3. Pipe and piping accessories.
4. Vibration Isolation.
5. Controls.
6. Testing and balancing of all systems.

C. General Items:

1. Access Doors Panels: Provide concealed controls, dampers, valves and equipment requiring access with adequately sized access doors/panels. In removable type ceiling, provide access tile identification only with permanent label identifying piece of equipment.
2. Cutting and patching for mechanical work.
3. Insulation: Furnish insulation for all piping, equipment and ducts that permit heat loss or gain or will form condensation.
4. Coordinate all new work with existing installations.
5. Condensate lines shall have no less than 1% minimum slope.

- D. Make-up water for any industrial equipment shall first pass through an approved backflow prevention unit.

1.02 REFERENCES

- A. The following published standards, codes, and specifications apply to all work within DIVISION 15.

1. AABC - Associated Air Balance Council.
2. ADC - Air Diffuser Council.
3. AMCA - Air Moving and Conditioning Association.
4. ANSI - American National Standards Institute.
5. ARI - Air-Conditioning and Refrigeration Institute.
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
7. ASME - American Society of Mechanical Engineers.
8. ASTM - American Society for Testing and Materials.
9. FM - Factory Mutual.
10. NEMA - National Electrical Manufacturer's Association.
11. NFPA - National Fire Protection Association.
12. OSHA - Occupational Safety and Health Act.

13. IBC – International Building Code.
14. UL - Underwriters' Laboratories, Inc.
15. IMC- International Mechanical Code.
16. IPC - International Plumbing Code.
17. National, State and Local Codes of all authorities having jurisdiction.
18. Local Utility Authorities.

1.03 QUALITY ASSURANCE

- A. All equipment and accessories shall be the product of a company regularly engaged in the manufacture of that product for at least five years.
- B. All equipment and accessories shall be new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.02 of this section and with all applicable national, state and local codes.
- D. All items of a given type shall be the products of the same manufacturer.

1.04 DESCRIPTION OF CONTRACT DOCUMENTS

- A. Specifications:
 1. Specifications, in general, describe quality and character of materials and equipment.
 2. Specifications are of simplified form and include incomplete sentences.
 3. Words or phrases such as "The Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" etc. may be omitted for brevity.
- B. Drawings:
 1. Drawings in general are diagrammatic and indicate scope, sizes, routing, locations, connections to equipment and methods of installation. The Drawings do not necessarily show all required offsets, obstructions or structural conditions. Locations on drawings may be distorted for purposes of clearness and legibility.
 2. Scaled and figured dimensions are approximate and are for estimating purposes only, but shall be followed with sufficient accuracy to coordinate with other work and structural limitations. **DO NOT SCALE DRAWINGS.**

3. Before proceeding with work, check and verify all dimensions and carefully check space requirements with other Work to ensure that all equipment and materials can be installed in spaces allotted.
 4. The Contractor shall assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 5. The Contractor is responsible for installing the work in such a manner that it will conform to the structure and architectural elements, avoid obstructions, maintain headroom, leave adequate clearance for proper maintenance and repairs, and provide clearances and access required by codes.
 6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 7. Above items to be performed at no additional cost to the Owner.
- C. Immediately and formally notify the Architect requesting his interpretation and decision, including during bidding period, if any part of the Contract Documents appears unclear or contradictory. Do not proceed with such work without Architect's decision.
- D. Accessibility:
1. Provide for operation, maintenance and repair.
 2. Minor deviations are permissible.
 3. Changes of magnitude or involving extra cost are not permissible without review.
 4. Group concealed mechanical equipment requiring access with equipment freely accessible through access doors.

1.05 PERMITS AND INSPECTIONS

- A. The contractor shall secure all approvals and pay all fees for all work installed. Certificate shall be delivered to owner before final payment will be made.

1.06 PROJECT CONDITIONS NOT USED.

1.07 QUALITY ASSURANCE

- A. Materials shall be new and free from defects and listed by Underwriters' Laboratories, Inc., (or other approved testing and listing agency) or bearing their

label. Conform to codes, standards and publications listed in paragraph 1.02
References.

1.08 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.
- B. Handle and ship in accordance with manufacturer's recommendations.
- C. Provide protective coverings during construction.
- D. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Architect.
- E. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.
- F. Include packing and shipping lists.

1.09 SUBMITTALS

Provide six (6) copies of submittal material with descriptive data for all products and materials prior to purchase and installation, including but not limited to the following:

- 1. Rooftop Packaged air conditioning units and split system units.
- 2. Ductless split systems.
- 3. Exhaust fans.
- 4. Evaporative coolers.
- 5. Valves.
- 6. Ductwork materials and methods of fabrication.
- 7. Ductwork accessories.
- 8. Flexible ducting.
- 9. Dampers.
- 10. Insulations and linings.
- 11. Pipe and piping accessories.
- 12. Diffusers, grilles and registers.
- 13. Air test and balance. (Complete forms proposed for use in compiling and recording test and balance data.)
- 14. Control devices and systems.
- 15. Vibration isolation.

16. Provide manufacturer's written guarantee that no asbestos materials are used in any proposed materials or equipment.

1.10 MAINTENANCE MANUALS AND RECORD DRAWINGS

- A. Provide four (4) copies of operating and maintenance manual for Owner's use for each piece of equipment. Each item shall be cross-referenced and numbered with as-built drawing descriptions.
- B. Deliver to Owner, two sets of redlined drawings in pdf format. Label drawings "RECORD DRAWINGS."

1.11 SEISMIC SUPPORT

- A. Contractor shall support and brace all new HVAC, plumbing and fire protection systems in accordance with seismic code requirements.

1.12 WARRANTY

- A. See General Condition of the Contract for Construction for general warranty provisions. Provide a (5) five year warranty on compressors for air conditioning equipment.

1.13 INDEMNIFICATION

- A. See General Conditions of the Contract for Construction for indemnification provisions.

PART 2 PRODUCTS

2.01 PACKAGED AIR CONDITIONING UNITS

- A. Trane
- B. Carrier.
- C. Lennox.
- D. Prior Approved Equivalentents.

2.02 EXHAUST FANS

- A. Greenheck

- B. Twin City Fan
- C. Cook
- D. Prior approved equivalent

2.03 EVAPORATIVE COOLERS

- A. Aerocool (Phoenix Manufacturing Company)

2.04 DUCTLESS SPLIT SYSTEM UNITS

- A. Mitsubishi
- B. LG
- C. Daikin
- D. Prior approved equivalent

2.05 DUCTWORK

- A. All ductwork, dampers, access doors, joints, hangers, stiffeners, fire/smoke dampers and fire retarding materials shall be in accordance with requirements of SMACNA (or UMC latest edition) "HVAC Duct Construction Standards." and all other authorities having jurisdiction. All sheet metal work shall have a pressure classification as follows:
 - 1. Supply duct between main loop and inlet to terminal air unit - 4 inches W.G.
 - 2. Supply ducts downstream of terminal air units, air handling units and fans -2 inches W.G.
 - 3. Return and exhaust air ducts - 2 inches W.G.
- B. Ductwork: Unless otherwise specified.
 - 1. Cold rolled "commercial" quality hot dipped galvanized in accordance with ASTM No. M525-67.
 - 2. Dimensions shown on drawings are clear inside dimensions.
 - 3. Fittings: Same gauge and construction as ducts. Elbows shall have centerline radius not less than 1.5 times width.
 - 4. Ducts with transverse and longitudinal bracings in accordance with SMACNA (or IMC adopted edition).

5. Evaporative cooler ductwork shall be commercial lock forming quality aluminum in accordance with SMACNA standards. Duct shall be prepared to receive paint (coordinate with architect).

C. Flexible Ductwork:

1. The flexible duct for connection of ceiling air diffusers to sheet metal duct shall be factory fabricated and assembly consisting of an inner sleeve, insulation and an outer moisture barrier. The inner sleeve shall be an elastomeric compound reinforced with woven fiberglass banded to a vinyl coated spring steel wire supporting helix. A minimum 1 inch thick fiberglass insulating blanket shall encase the inner sleeve and be sheathed with an outer moisture barrier of a reinforced metalized Mylar/neoprene laminate, or equivalent.
2. Acoustical performance of the flexible duct shall be in accordance with Air Diffusion Council Flexible Air Duct Test FD72R1, paragraph 3.2.1, Sound Attenuation.
3. Installation of the flexible duct shall be in accordance with the manufacturer's instructions and recommended procedures.
4. Flexible ductwork to be a maximum of 14 ft. in length. On runs requiring over 14 ft., install balance of duct run in sheet metal with standard sheet metal fittings. Residential unit flexible duct lengths may exceed 14 feet provided final air quantities can be achieved.
5. All connections shall be airtight joints, fastened with clamps and sealed with sealing compound and tape.
6. Flexible duct bends shall be installed with centerline radius not less than 1.5 time diameter and shall not be crushed to fit limited clearance.

D. Access Doors:

1. Furnish access door of sufficient size as required, for access, inspection, maintenance, and replacement to all instruments, controls and equipment.

E. Dampers:

1. Furnish all dampers necessary for proper control and balancing of air distribution as follows:
 - a. All ducts which split in 2 or more branches to serve supply diffusers.

- b. At each supply and return branch duct, as far away from each outlet and inlet as possible.
 - c. Where indicated on the Drawings.
 - d. Field fabricated dampers are not acceptable.
- F. Fire/smoke dampers shall be designed and constructed in accordance with NFPA Standard 90A and UL Standard 555 and UL Standard 555S and shall be so labeled with a permanent identification. Fire/smoke dampers shall be out-of-air stream type with a factory supplied sleeve.
- G. Turning vanes shall be galvanized steel, single thickness turning vanes with 2 in. inside radius for all square elbows of main trunks and branches unless noted otherwise. Provide turning vanes at all elbows greater than 8"x8".

2.06 AIR OUTLETS AND INLETS

- A. All diffusers, grilles and registers shall be of type and capacity as indicated on drawings. Diffusers shall have no visible screw heads or connectors.
- B. Balancing dampers shall be provided in the branch duct as far as possible from all supply and return air devices and shall be adjustable and accessible.
- C. Supply air diffuser plenums shall be lined with 1/2" lining unless otherwise noted.

2.07 ROOM THERMOSTATS

- A. Thermostats shall be *programmable, 24/7 electronic with battery backup*.

2.08 ESCUTCHEONS

- A. Provide exposed piping with escutcheons where passing through walls, ceilings or partitions.
- B. Provide sleeving for all piping that penetrates floor slabs.

2.09 HVAC WATER AND REFRIGERANT PIPING (Fan coil connections, condensate)

- A. Pipe shall be seamless copper tubing, Type L, cold drawn, hard temper, ASTM B88. ACR will be accepted for fan coil connections within the individual living units and all 8th floor and first floor systems. Risers extending more than 20 feet vertically shall be rigid copper tubing.

- B. Fittings shall be wrought copper solder sweat type. ANSI B16.22 or brass castings, ANSI B16.18.
- C. Joints shall be 95-5 (tin and antimony) solder.
- D. Connection between dissimilar metals shall be isolated by means of approved dielectric fittings.
- E. Testing:
 - 1. HVAC:
 - a. Condensate systems.
 - 1) Test hydrostatically to 15 feet.
 - b. Refrigerant systems Test and Evacuation:
 - 1) Test piping using dry and oil free nitrogen to 300 psi on high side, 150 psi on low side. Maintain pressure for 2 hours with no leakage.
 - 2) Evacuate using high vacuum pump and certified micron gage. Reduce absolute pressure to 300 microns. Charge system with proper refrigerant until pressure of 0 psi is obtained. Repeat procedure two more times. On fan evacuation keep at 300 microns for 2 hours before final charge.
 - 3) Never exceed test pressure ANSI B16.1 basis.
 - c. Leaks and defects:
 - 1) Repair or replace as directed.
 - 2) Without additional cost.
 - d. Notify the Architect in writing one week before test.
 - e. Furnish written report and certification that tests have been satisfactorily completed.

2.10 SUPPORTS AND ANCHORS

- A. Pipe Hangers, Supports, and Guides:

1. General:
 - a. Assure adequate support for pipe and contents.
 - b. Prevent vibration or swaying.
 - c. Provide for expansion and contraction.
 - d. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted.
 - e. Comply with applicable requirements at ANSI B31.1.0 and B31.2 for piping.
 - f. Support piping so that equipment is not stressed by piping weight **or** expansion.
 - g. Hangers and supports shall have minimum safety factor of three (3), based on ultimate tensile or compressive strength, as applicable, of material used.
 - h. Prime coat exposed steel hangers and supports:
 - 1) Hangers and supports located in crawl spaces, pipes shafts and suspended ceiling spaces are not considered exposed.
2. Horizontal piping, except as noted:
 - a. Adjustable clevis type and rod:
 - 1) All services at or below 250 deg F.
 - b. Rollers or slide bases:
 - 1) Pipe stand, bracket, trapeze or other equivalent structural support.
 - 2) Rollers not required where spring hangers are called for.
 - c. Trapeze hangers:
 - 1) Guide individual pipes on trapezes with 1/4 inch U-bolt or Superstrut 702 pipe clamp.
 - a) Install thermal hanger shield at each support point.
 - d. Threaded steel rods:
 - 1) 2 in vertical adjustment with 2 nuts each end for positioning and locking.

2) Size to 12 in IPS:

Pipe, IPS	Rod
To 2 in.	3/8 in.
2-1/2 in. and 3 in.	1/2 in.
4 in.	5/8 in.

3. Install Pipe isolators between hangers and:

- a. Uninsulated copper tubing.
- b. Wherever any pipe requires sound and vibration isolation.

4. Steel support components shall be separated from copper piping with plastic tape.

5. Spring Supports for Piping:

- a. Minimum static deflection shall be 1 inch unless noted otherwise.

6. Miscellaneous Steel:

- a. Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions.

B. Pipe Support Spacing:

1. Maximum spacing for horizontal piping:

Type of Pipe	Size	Maximum Spacing
Steel	1-1/2 in. and smaller	7 ft
	2 in. and larger	10 ft
Brass or copper	3/4 in. and smaller	5 ft
	1- 1-1/4 in.	6 ft
	1-1/2 to 3 in.	8 ft
	4 in. and larger	10 ft

Bell and Spigot (Notes 1, 2, 3)	All	10 ft
Hubless C.I. (Notes 2, 3, 4)	All	10 ft

Spacing Notes:

Note 1. Typical of cast iron and duriron.

Note 2. Two supports per joint.

Note 3. Support to be within 18 inches of hub or joint.

Note 4. Support to be placed on or immediately adjacent to coupling.

Note 5. Additional supports at:

- a. Changes in direction.
- b. Branch piping and runouts over 5 ft.
- c. Concentrated loads due to valves, strainers and other similar items.
- d. At valves 4 in. and larger in horizontal piping.
- e. Support piping on each side of valve.

2. Brace hubless piping to prevent horizontal and/or vertical movement.

3. Parallel piping on trapezes:

- a. Maximum spacing to be that of pipe requiring closest spacing.

4. Support standpipes and fire sprinkler piping in accordance with NFPA.

C. Attachment to Structure:

1. Steel Beam Anchors:

- a. Approved beam or channel clamps.
- b. Do not cut or weld to structural steel without written approval of Owner and Structural Engineer.
- c. Other methods as detailed on drawings.

2. Steel Deck Anchors: No attachment to metal deck permitted without written approval of Owner's representative.
 - a. Concrete filled: as specified above.
3. Side Wall Supports:
 - a. Concrete walls: As specified for hangers.
 - b. Stud Walls:
 - 1) Toggle bolts.
 - 2) Studs welded to structural studs.
 - 3) Lag screws into wood backing.
 - 4) Other methods.
4. Support Spreaders:
 - a. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment.
 - b. Spreaders may be one of methods listed below, or combination of both as required:
 - 1) Fabricated from structural channel:
 - a) End fittings bolted or welded.
 - b) Secure to structural members:
 - (1) As required by construction.
 - (2) As approved by Structural Engineer.
 - 2) Formed channels with fittings, similar to Superstrut:
 - a) Submit manufacturer's calculations for installation.

D. Duct Hangers and Supports:

1. General:
 - a. Support horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA Duct Construction Standards.

2. Horizontal Duct Supports:

- a. Install hangers at each change in direction of duct.
- b. Strap hangers:
 - 1) Extend strap down both sides of ducts.
 - 2) Turn under bottom one inch minimum.
 - 3) Metal screw hangers to :
 - a) Bottom of duct.
 - b) Upper and lower sides of ducts.
 - c) Not more than 12 inches on center.
- c. Angle hangers:
 - 1) Provide angle hangers formed by extended vertical bracing angles.

2.11 ACCESS DOORS

- A. Provide equipment and concealed valve access, except in removable tile ceilings and approved by local code, with adequate size access doors for inspection and maintenance.

2.12 INSULATION AND LINING

- A. Materials:
 - 1. Insulation, jackets, facings, adhesives, coatings, and accessories shall have a fire hazard rating by Underwriters Laboratories, Inc. Steiner tunnel test method for fire hazard classification of building materials, standard UL 723, ASTM E-84, NFPA-225.
 - a. Flamespread: Maximum 25.
 - b. Fuel contributed and smoke developed: Maximum 50.
 - c. Flameproofing treatments subject to deterioration due to moisture or humidity not acceptable.
 - 2. Insulation shall be Johns Manville, or equal.
 - 3. Label as required by code.

- B. All insulation applied according to manufacturer's published recommendations.
- C. Insulate all piping, ductwork and equipment, except as follows:
 - 1. Vents, overflow, cold water, drain and relief piping except where indicated on the plans.
 - 2. Return air ducts in conditioned spaces and exhaust air ducts, except where indicated.
- D. Type of Insulation:
 - 1. Duct insulation: 1-1/2-inch thick, 3/4 lb. density, glass fiber insulation, with aluminum foil facing. Manville R-Series Microlite, except for exposed duct in air conditioned areas.
 - 2. Duct lining: 1/2-inch thick, 1-1/2 lb. density coated on air side with a fire resistant black neoprene coating for living areas, 1" thick (same material) for commercial spaces. Manville Linacoustic first 15' of new ductwork, except exposed duct in air conditioned areas. For exposed duct, line first 10 feet with 1" liner and balance of ductwork with 1/2" liner.
 - 3. Piping:
 - a. Refrigerant piping:
 - 1) 1/2" Armaflex or equivalent cellular foam insulation with all fittings covered. All taped or hot-glued sections shall be banded with stainless steel bands. Outdoor insulated piping shall have embossed aluminum jacketing.

2.13 IDENTIFICATION

- A. An identification label shall be provided for the following types of equipment:
 - 1. Heat pumps.
 - 2. Split ductless units
 - 3. Exhaust fans.
 - 4. Damper Motors.
 - 5. Valves.
- B. Identification labels shall be by Seton, or equivalent.

2.14 ASBESTOS

- A. Absolutely no asbestos shall be allowed on the project site.

2.15 CURBS

- A. All air conditioning equipment curbs shall be provided by unit manufacturer and shall be welded or bolted. Any substitutions shall have written approval from the unit manufacturer and the Owner prior to purchase or installation.

2.16 FILTER ACCESS

- A. Filters shall be mounted fully within the unit cabinet and accessible without removal of any screws (cam lock or similar is OK).

PART 3 EXECUTION

3.01 INSTALLATION OF THE WORK

1. It is the responsibility of the Contractor to install the work in such a manner that it will be at the highest elevation possible, conform to the structure, avoid obstructions, maintain headroom, leave adequate clearances for light fixtures, return air pathways, maintenance and repairs, and provide clearance and access as required by codes. Nothing shall be installed below ceiling level without Architect's written consent.
2. Above items to be performed at no additional cost to the Owner.
3. Proceed as rapidly as the building construction will permit.
4. Thoroughly clean items before installation. Cap openings to exclude dirt until final connections have been made.
5. Cut materials accurately, work into place without springing or forcing, properly clear windows, doors and other openings. Excessive cutting or other weakening of the building structure will not be permitted.
6. Manufacturer's drawings and instructions shall be followed in all cases where the makers of devices and equipment furnish directions or details not shown on the drawings or described in the specifications.
7. Drawings are not intended to be scaled, but shall be followed with sufficient accuracy to coordinate with other work and structural limitations.
8. All work shall be properly supported from building structure and/or framing in an approved manner, independent of the ceiling support system. Where overhead construction does not permit direct fastening of supports, furnish additional framing.
9. All equipment shall be securely fastened to building construction with approved supports.

10. Refer to architectural drawings for exact location of diffusers, grilles, registers, and thermostats (if depicted). If thermostats are not depicted specifically on Architect's drawings, obtain Architect's approval for locations prior to installation.
11. Coordinate the work of this section with the work of other sections in ample time for proper installation and connection.
12. Carefully check space requirements, including servicing space requirements, with other sections to ensure that all equipment and materials can be installed in the spaces allotted thereto.
13. Prepare drawings, attend meetings, obtain all approvals required by all authorities having jurisdiction, conduct required tests and obtain required permits.
14. Paint ductwork visible through grilles, registers, diffusers or ceiling flat black.

B. General:

1. Painting:
 - a. Paint:
 - 1) Best grade for its purpose.
 - 2) Deliver in original sealed containers.
 - 3) Apply in accordance with manufacturer's instructions.
 - 4) Colors: As selected by Architect.
 - b. Galvanized iron primer.
 - c. Hot dipped galvanized or dipped in zinc chromate.
 - d. Zinc chromate with finish to match surroundings.
2. Cleaning:
 - a. Brush and clean work prior to concealing, painting and acceptance.
 - b. Painted exposed work soiled or damaged: Clean and repair to match adjoining work before final acceptance.
 - c. Remove debris from inside and outside of material and equipment.
3. Cutting and Patching: As required for new work.

3.02 CONTROL DEVICES

- A. All control devices not specified to be furnished and installed under the Electrical sections shall be provided under this section.

3.03 TESTING AND BALANCING

- A. General:

- 1. Adjustment: Each piece of equipment and all of the systems shall be adjusted to insure proper functioning of all controls, and shall be left in operating condition.
- 2. Preliminary Operation: The Owner reserves the right to operate any systems or equipment prior to final completion and acceptance of the work. Such preliminary operation shall not be construed as an acceptance of any work.

- B. Air Distribution Systems:

- 1. Balance and adjust air distribution system to quantities indicated on drawings in accordance with Associated Air Balance Council (AABC) manual, latest edition.
- 2. Balancing and testing shall be performed and supervised by a certified independent firm specializing in testing and balancing. Firm shall be a member of AABC. Test reports shall be submitted in bound folders and on AABC type report forms. All diffusers shall be identified by designations on drawings.
- 3. Diffuser air delivery shall not be less than nor exceed by more than 5% the air delivery indicated on the plans.
- 4. Upon completion of the installation, Contractor shall rebalance any air distribution system affected by the renovation, including terminal air units and air outlets.

3.04 PROJECT CLOSE-OUT

- A. After final operation for inspection and acceptance, deliver all copies of operation instructions, maintenance manuals and parts descriptions to the Architect.
- B. All tools supplied with the equipment for maintenance shall be tagged and temporarily secured to the unit, or turned over to the Owner.

END OF SECTION

SECTION 26 00 01

GENERAL ELECTRICAL REQUIREMENTS NEW CONSTRUCTION

PART 1 - GENERAL REQUIREMENTS

- 1.1 Provide all necessary labor, materials, and equipment for completion of all work in this specification and as detailed and required by Drawings.
- 1.2 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - SCOPE

- 2.1 The work under this Section shall include the furnishing and installation of all materials, tools, equipment, labor, etc. which are required for the complete installation of the Electrical work, as indicated on the Drawings and/or the Specifications. Coordination with other trades shall be considered a part of the Electrical herein required.
- 2.2 Work or equipment not indicated or specified which is necessary for the complete and proper operation of the Electrical systems shall be accomplished without additional cost to the Owner.
- 2.3 The Electrical work shall include, but not be limited to, the following units, systems, and components, furnished and installed in a completely workable installation:
 - A. Electrical Service Equipment, including coordination with the local Power Company serving the facility.
 - 1. Electrical Distribution Equipment.
 - 2. Grounding System.
 - 3. Lighting system.
 - 4. Wiring and connection for all equipment and devices.
 - 5. Empty Raceway Systems.

PART 3 - MATERIALS

- A. STANDARDS OF MATERIALS. All materials shall be new and shall bear the label of the Underwriter's Laboratories, Inc. All materials shall be factory assembled with U.L. labeling.
- B. All material shall be new and of the best grade and latest pattern of manufacture as specified. All work shall be performed in a neat, workmanlike manner and shall present a neat mechanical appearance when completed.

PART 4 - INSTALLATION

- 4.1 CODES AND PERMITS
 - A. All work shall be executed in accordance with OSHA and the local, state, and national codes, ordinances and regulations governing the particular class or work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. Upon completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and, in completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Engineer upon request. The following specifications and standards shall form a part of these specifications:
 - 1. National Fire Protection Associates Standards
 - 2. National Electrical Code (Current Edition) NFPA 70
 - 3. National Electrical Manufacturer's Association (NEMA)

- B. This Contractor shall secure all permits and licenses required for his work and shall pay all fees in connection with such permits and licenses.

4.2 DRAWINGS

- A. Drawings and specifications shall be considered as complimentary, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.
- B. In the case of discrepancies in figures, drawings, or specifications, the Engineer shall be notified immediately and his decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at his expense; and, in case of any settlement or any complication arising from such adjustment by the Contractor, he shall bear all extra expense involved.
- C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Engineer to supply the same and the Contractor shall conform to same as part of the Contract.
- D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Engineer, Architect or Owner will be accepted as an excuse for inferior work.
- E. In all spaces, such as ceiling spaces and equipment rooms, all conduits shall be run to a continuous grade and square to the building.
- F. This Contractor shall thoroughly acquaint himself with the details of the building plans and construction before submitting his bid as no allowance will be made because of this Contractor's unfamiliarity with these details. He should inspect the existing site conditions carefully before submitting his Bid.
- G. The plans do not give exact details of all elevations of conduits, exact locations, etc. and do not show all offsets, bends, junction boxes, and other installation details. The Contractor shall carefully lay out his work at this site to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.
- H. The equipment is laid out with respect to available space. The Contractor shall be responsible for all equipment clearances and dimensions. If the equipment which any Contractor or utility company proposes to install require other space conditions than those indicated on the drawings, the Contractor shall submit to the Engineer for approval, a drawing showing proposed locations for equipment. Should changes become necessary due to failure of Contractor to provide adequate space, the Contractor shall bear all cost for such changes.
- I. All equipment shall be installed in accordance with the manufacturer's recommendations.
- J. The Electrical Plans are diagrammatic, but shall be followed as closely as actual construction and the work of other trades will allow. Prior to rough in, this Contractor shall verify exact locations with all other trades, all equipment connections, and adjust locations as required. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.
- K. Circuits and feeders shall be as shown and no deviations from the indicated outlet circuit grouping will be permitted, except by permission of the Engineer. Branch circuit numbers are mandatory and shall be changed only on written permission from the Engineer. Any changes in layout or circuit numbering shall be accurately recorded on the "as built" drawings by the Contractor, and reflected in the panel schedules.

4.3 PROTECTION OF MATERIALS AND EQUIPMENT

- A. This Contractor shall be responsible for the protection of all work, materials, and equipment under this section of the work whether incorporated into the building or not.
- B. The Contractor shall provide protection for all work where necessary and will be responsible for all damage done to property during the construction. The above protection shall be maintained while the work is in progress. In no case shall dirt, grit, etc. be ground into the floor finish or coverings.
- C. The Contractor shall provide space for storage of materials and equipment.

4.4 EXCAVATION AND BACKFILLING

- A. This Contractor shall do all necessary excavation and backfill for the installation of the systems as may be required. Curb cuts, asphalt and concrete patching, etc. shall be part of this Contractor's responsibility. Any retrenching will be done by hand and all existing utilities avoided. Damage done to existing utilities will be repaired by this Contractor with no additional payment for the work. In addition to the above, trenches shall be backfilled with dirt, free from debris, rocks, and other foreign matter. Backfill shall be replaced in the trenches in 6 inch layers and each 6 inch layer shall be wetted down and adequately and properly tamped. Remove surplus dirt, debris, pavement, etc. and leave premises clean.

4.5 CUTTING AND REPAIRING. Any cutting and/or repairing shall be the responsibility of the Contractor. Coordinate to prevent unnecessary cutting and repairing. Lay out and locate equipment openings and chases, install sleeves, inserts, and supports. Repairing of surfaces shall be the responsibility of the Contractor, and surfaces, equipment, etc. shall be restored to their original condition.

4.6 CHANGES/SUBSTITUTIONS AND PRIOR APPROVALS

- A. No changes or substitutions shall be made in the electrical equipment, materials or work as shown on the Drawings and herein specified, unless such changes are authorized in writing by the Engineer and/or Architect. All substitutions shall be requested in letters from the Contractor to the Engineer and/or Architect in accordance with the GENERAL CONDITIONS of these Specifications or as noted in this Section. Request for prior approvals shall be in the hands of the Engineer and/or Architect at least 7 calendar days prior to bid opening. Equipment, materials or work shall be considered as authorized for substitution only upon written permission from the Engineer or Architect. Where materials are proposed to be substituted in lieu of the specific items specified, substitutions shall be equal in quality, workmanship, and design. The burden of proof of equality of materials shall be placed upon the Contractor or Supplier. Samples of equipment or materials proposed for substitution shall be submitted to the Engineer for examination at Engineer's request. Substitutions based on catalog data only may not be permitted.
- B. Requests for prior approval shall be in the form of catalog cuts for all proposed materials or equipment to be substituted. The catalog cuts shall contain all pertinent information highlighted on the proposed substitute materials or equipment. The request for prior approval shall have a cover letter stating the name of the project, bid date, etc. and shall have the names and catalog numbers of the equipment specified with their appropriate specification section, and similar information for the proposed substitute. Prior approval may be submitted in either of two formats: hard copy or PDF format, unless PDF format is prohibited by the Architect. Hard copy prior approval requests shall be bound. Loose sheets will not be accepted. All information for comparison of the proposed equipment shall be included in the request for prior approval. Failure to provide all pertinent information before the deadline may result in not receiving approval of equipment. Transmission of prior approval requests via a facsimile machine is not acceptable. Additional requirements for prior approvals may be stated in the section in which the particular equipment or materials are specified. Those requirements shall be as though repeated herein. PDF format requests for prior approval shall contain all information for similar equipment in a single PDF file.
- C. If changes and/or substitutions are made under this Division of the Specification, the Contractor shall assume all responsibility for such changes and/or substitutions. This shall include coordination with all trades associated with the modification, and all costs incurred by all trades involved. All costs associated with substitution and/or change in the electrical work under this Division or any other Division of this Specification, shall be the responsibility of the Contractor.

4.7 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals and shop drawings shall be furnished for equipment and materials to be furnished for the Project. They shall be furnished by the Contractor as required in the General Conditions of the specifications and as specified herein.
- B. Within TWO WEEKS after being awarded the Contract, the Electrical Contractor shall submit complete sets of submittals and shop drawings to the Engineer for review. This review will be for the purpose of checking compliance with contract documents. The review will not include review of dimensions or quantities. Notwithstanding this review, the Contractor shall be responsible for all equipment and materials.
- C. Shop Drawings and Submittals for equipment shall include manufacturer's name, trade name, place of manufacture, catalog data, model number, nameplate data, size, layout dimensions, capacity and other information necessary to establish compliance with contract for each item of equipment. Submittal sheets shall be 8½" by 11". Shop drawings and submittals shall be in the form of catalog cuts for all materials or equipment. The catalog cuts shall contain all pertinent information on the materials or equipment, including optional equipment and accessories included with equipment. All catalog sheets shall be identified in such a manner as to relate to the specific project. Shop drawings and submittals shall have a cover letter stating the name and address of the project, contractor name, address, telephone number, name of contact, etc. and shall have the names and catalog numbers of the equipment specified with their appropriate specification section number. Shop drawings and submittals shall be bound in orderly fashion. Loose sheets will not be acceptable. Shop drawings may be submitted at PDF format. Additional requirements for shop drawings and submittals may be stated in the section in which the particular equipment or materials are specified. Those requirements shall be as though repeated herein.
- D. Shop drawings shall be 8½" by 11" in size, except as specified otherwise. Drawings shall include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories and other items that must be shown to assure a coordinated installation. Larger drawings shall be folded and bound with other information.
- E. Submittals required include, but are not limited to, the following:
1. Electrical Service Entrance Section
 2. Panelboards
 3. Circuit Breakers
 4. Fuses
 5. Devices
 6. Safety Switches
 7. Lighting Fixtures
 8. Fire Alarm System Components
 9. Engine Generators
 10. Transfer Switch
 11. Wire and Cable
 12. Vehicle bay exhaust / make-up air system controls.
- F. Shop drawings required include, but are not limited to, the following:
1. Service Entrance Section
 2. Panelboards
 3. Switchboards
 4. Engine Generator
 5. Fire Alarm System
- G. All descriptive and technical data, submittals and shop drawings shall bear signed certification to the effect that they have been carefully examined by the Contractor, and found to be correct with respect to dimensions, space available, non interference with other trades, and that the equipment complies with all the requirements of these specifications. Failure to provide such certification shall cause for immediate rejection of all shop drawings and submittals. Submittals must be made for all items of material to be furnished by the Contractors. Shop drawings shall be made for all systems furnished by the Contractor. Partial submission of submittals or shop drawings is not acceptable and will be rejected on that basis without review. Submittals and shop drawings shall be bound in complete sets in portfolio binders and shall be dated, shall have the project title, contractor company name, address, telephone number, superintendent and/or contact on the front cover. The total number of shop drawing submittals shall be in

accordance with the GENERAL CONDITIONS, but not less than six complete sets. Lighting fixture, fire alarm, intercom, sound system or other special systems may be bound in separate binders. Shop drawings may be submitted at PDF format. Additional requirements for shop drawings may be stated in the respective specification section. Those requirements shall be as though repeated herein.

- H. Should shop drawings or submittals be required for resubmittal, the entire set shall be resubmitted with the appropriate new sheets inserted in the proper place. The Contractor shall affix his certification to any and all new sheets of the resubmission as required in the previous paragraph.
- I. After review of submittals and shop drawings, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is to facilitate progress on the job. Failure on the part of the Contractor to comply shall render him liable for the expense of any and all delays occasioned by this failure.

4.8 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. It shall be the responsibility of this Contractor to furnish two (2) complete sets, properly bound in a portfolio binder or three ring note book, of operating and maintenance instructions for all Contractor furnished equipment. This Contractor shall instruct the Owner's representative in the operation of all equipment. All pertinent information on the complete operation and maintenance of all equipment shall be furnished in the Operating and Maintenance Manuals. At the option of the Owner, Operating and Maintenance manuals may be submitted in PDF format on a CD.
- B. The first section of the Operating and Maintenance Manual shall be a section which shall contain maintenance schedules for all equipment. Each piece of equipment shall be listed, complete with manufacturer and catalog number or model number. Information shall include frequency of all maintenance items and description of all such maintenance. List the piece of equipment and then all maintenance items under the equipment with the most frequently required maintenance items followed by the less frequently required maintenance items.
- C. The second section of the Operating and Maintenance Manual shall be a section containing all descriptive data on all equipment. Information shall include, but not be limited to the following: complete operating instructions, detailed information on maintenance, warranty information, service instructions, wiring diagrams, and all other information on each piece of equipment. Systems shall be grouped in logical order, and shall have tabbed dividers. For example, service entrance equipment shall be separated from lighting fixtures.
- D. The Operating and Maintenance Manuals shall have an index which shall provide easy referencing for each section. The index tabs shall be for each system. Each section shall be arranged so that the most technical information is toward the back of the section.
- E. Other criteria for the Operating and Maintenance Manuals may be included in subsequent sections of this Electrical Specification, and shall be included, as though printed herein.

4.9 SITE VISIT

- A. The Contractor shall visit the site prior to bidding and satisfy himself as to the conditions under which the systems are to be installed. No subsequent allowance shall be made on his behalf for failure to make such a visit or to determine for himself, all existing conditions.

4.10 FIELD MEASUREMENTS

- A. The Contractor shall verify the dimensions covering the work. No extra compensation shall be claimed or allowed due to difference between actual dimensions and those indicated on the drawings. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting this work.

4.11 CLEANUP

- A. In addition to general cleanup, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove from all cracks and corners.
- B. During the progress of the work, keep the premises clean and free of debris.

4.12 IDENTIFICATION OF EQUIPMENT

- A. All electrical equipment shall be labeled, with engraved plastic laminated nameplates, as shown on plans or as directed by the Owner.

4.13 RECORD DRAWINGS

- A. Maintain, at the project site, a set of prints on which a daily record of changes and deviations from contract drawings and specifications are recorded. A set of Record drawings shall be done with Red pencil, and shall show all changes as well as all buried or concealed conduit, size 1" and larger, both inside and outside the building. Conduits shall be dimensioned and located with reference to Architectural drawings by dimensions on prints. Include all other pertinent information necessary for future renovation.
- B. Upon completion of the project submit the "red line as built" drawings to the Architect for review.
- C. After review by Architect and/or Engineer the "red line as built" drawings will be returned to the Contractor for production of "as built" reproducible plans. The Contractor shall be responsible for obtaining an erasable mylar set of sepias of the Contract plans. These are printed at no additional cost to the Owner or the Architect/Engineer. The Contractor shall modify the mylar sepias to reflect all the changes to show "as built" conditions. Modifications shall be produced on the sepias in the same quality of workmanship as the original drawings were reproduced.

4.14 PAINTING

- A. Scratched or marred surfaces of electrical equipment shall be painted with factory supplied paint prior to final inspection. Items which are not, or cannot be satisfactorily touch up painted shall be replaced at no additional cost to the Owner.
- B. Items to be painted as shown on the drawings or as specified herein shall be painted in accordance with the Painting section of this Specification when included. All items to be painted shall be first painted with a factory applied prime coating. Coordinate with all other trades to assure that all items to be painted are properly covered. If a Painting section is not included in the specification, the painting shall be the responsibility of this section of the Specification. The paint shall be as specified on the plans, or as recommended by the manufacturer or Architect/Engineer.

4.15 FINAL COMPLETION AND TEST

- A. Independent testing may be required by other sections of this Specification. Provide independent testing as described elsewhere on the Drawings and/of Specifications.
- B. Upon completion of the work, all systems shall be tested for short circuit conditions prior to energizing circuits.
- C. The complete system shall operate satisfactorily in every respect. Make any repairs or adjustments necessary to this end to the satisfaction of the Engineer.
- D. Furnish all instruments and labor for testing.

4.16 GUARANTEE

- A. All equipment and workmanship to be furnished under this Contract shall be guaranteed in writing for a period of one year from the date of final acceptance thereof against defective materials, design, and workmanship. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment

during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. The labor incident to the installation of these replacements shall be furnished by the Contractor.

4.17 MISCELLANEOUS ITEMS

- A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed and connected in the proper manner and as recommended by the manufacturer.

4.18 ENGINEER'S LIABILITY

- A. The Engineer's liability shall be limited to acts caused directly by his negligence. The Engineer shall assume no responsibility for acts of negligence caused by Contractor or others.

END OF SECTION 26 00 01

SECTION 26 01 26
ELECTRICAL TESTING

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 general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:
 - 1. Qualifications of testing agencies and their personnel.
 - 2. Suitability of test equipment.
 - 3. Calibration of test instruments.
 - 4. Coordination requirements for testing and inspecting.
 - 5. Reporting requirements for testing and inspecting.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.
 - 1. Independent Testing Agencies: Independent of manufacturers, suppliers, and installers of components to be tested or inspected.
 - a. Testing Agency's Field Supervisor for Power Component Testing: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Division 26 power component Sections.
- B. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.
- C. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL TESTS AND INSPECTIONS

- A. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:
 - 1. Perform insulation-resistance tests.
 - 2. Perform continuity tests.

- B. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:
 - 1. Manufacturer's written testing and inspecting instructions.
 - 2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
 - 3. Tabulation of expected measurement results made before measurements.
 - 4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION 26 01 26

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

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. Supporting devices for electrical components.
 2. Electrical identification.
 3. Concrete equipment bases.
 4. Cutting and patching for electrical construction.
 5. Touchup painting.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 1. Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) on center, in webs.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Expansion Anchors: Carbon-steel wedge or sleeve type.
- G. Toggle Bolts: All-steel springhead type.
- H. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
 - 1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
 - 2. Legend: Indicates voltage.
- C. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).

2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
 4. Printed legend that indicates type of underground line.
- D. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- E. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- G. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers or rivets.
- I. Label ALL switches, receptacles, junction boxes, panelboards and disconnect switches with source and circuit number.
1. Switches and receptacles shall be with label maker on clear label with black lettering.
 2. Visible junction boxes shall be with label maker on clear label with black lettering.
 3. Hidden junction boxes shall be labeled with permanent marker.
 4. Disconnects switches and panelboards shall be labeled with laminated engraved nameplate shall be riveted in place. Identification shall include name of device/panel as well as source and circuit number(s).

2.3 CONCRETE BASES

- A. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength.

2.4 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- H. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- J. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

- K. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
1. Wood: Fasten with wood screws or screw-type nails.
 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 3. New Concrete: Concrete inserts with machine screws and bolts.
 4. Existing Concrete: Expansion bolts.
 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 8. Light Steel: Sheet-metal screws.
 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.
 3. Colors: As follows:
 - a. Fire Alarm System: Red.
 - b. Security System: Blue and yellow.
 - c. Telecommunication System: Green and yellow.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
- F. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

- G. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.5 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.6 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.7 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.8 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
1. Raceways.
 2. Building wire and connectors.
 3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Concrete bases.
 6. Electrical demolition.
 7. Cutting and patching for electrical construction.
 8. Touchup painting.

3.9 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 19
CONDUCTORS AND CABLES

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 building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. Alcan Aluminum Corporation; Alcan Cable Div.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- D. Conductor Insulation Types: Type THHN-THWN or XHHW complying with NEMA WC 5 or 7.
- E. Multiconductor Cable: Metal-clad cable, Type MC with ground wire (for use only as noted in Section 3.1.H).

2.3 CONNECTORS AND SPLICES

- A. Available Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Hubbell/Anderson.
 - 4. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated. Wire caps shall be twist type only.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, or XHHW single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. 6' Whips (maximum length) to Lighting Fixtures: Metal-clad cable, Type MC.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- J. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- K. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- G. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 9 inches of slack.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING

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 grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.

- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: Refer to plans for sizes.
- I. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 by 120 inches (19 by 3000 mm) or 5/8 by 96 inches (16 by 2400 mm) in diameter.

PART 3 - EXECUTION

3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- C. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- D. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.

3.6 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 26 05 26

SECTION 26 05 33
RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 2. Division 26 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Aluminum Rigid Conduit: ANSI C80.5.
- C. IMC: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Plastic-Coated IMC and Fittings: NEMA RN 1.
- F. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Set-screw or compression type.
- G. FMC: Utility, Electrical or Mechanical (or similar applications) use zinc coated steel, other applications use aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket.
- I. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- C. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- D. LFNC: UL 1660.

2.3 METAL WIREWAYS

- A. Material and Construction: Sheet metal sized and shaped as indicated on plans.

- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: As indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
- B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum size: 4" square, 2.25" deep.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Floor Boxes:
 - 1. Refer to plans for device type and conduit requirements.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1 or 3R (per plans), with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- G. Cabinets: NEMA 250, Type 1 or 3R (per plans), galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 FACTORY FINISHES

- A. Finish: For raceways, enclosures, and cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Exposed: RNC to 24 inches (610 mm) above finished floor, EMT otherwise.
2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel or nonmetallic.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

- H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above the floor.
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- K. Tighten set screws of threadless fittings with suitable tools.
- L. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 18 inches of slack at each end of pull wire.
- N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used

6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

- Q. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- S. Set floor boxes per type and as required by device manufacturer.
- T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 05 33

SECTION 26 24 13

SWITCHBOARDS

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 service and distribution switchboards rated 600 V and less.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. SPDT: Single pole, double throw.
- D. DPST: Double pole, single throw.

1.4 SUBMITTALS

- A. Product Data: For Service Entrance Section and each type of switchboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of switchboards and overcurrent protective devices.
 - d. Utility company's metering provisions with indication of approval by utility company.
 - e. UL listing for series rating of installed devices.
 - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Maintenance Data: For switchboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

D. Shop Drawing and Submittal Requirements: Shop drawings and submittals shall be bound in 8½" by 11" notebook form. Sheets larger than notebook size shall be folded into notebook size. Include title sheet with project information, owner information, contractor information and supplier information. Shop drawing and submittal package shall contain complete submittal information. Incomplete submittals shall be cause for rejection. Generate a PDF file of the complete set of shop drawings and submittals and email to the power company.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 2.

D. Comply with NFPA 70.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards, including clearances between switchboards, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in sections of lengths that can be moved past obstructions in delivery path.

B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards.

D. Handle switchboards according to NEMA PB 2.1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 120 deg F.
2. Altitude: Not exceeding 1100 feet.

B. Service Conditions: NEMA PB2, usual service conditions, as follows:

1. Altitude not exceeding 1100 feet.
2. Ambient temperatures within limits specified.

1.8 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCT

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Corp.; Cutler-Hammer Products.
 2. Siemens.
 3. Square D.

2.2 MANUFACTURED UNITS

- A. Front- and Side-Accessible Switchboard: Fixed, individually mounted main device, group-mounted branches, and sections rear aligned.
 1. Main Devices: Fixed mounted.
 2. Branch Devices: Group mounted. Refer to plans for additional branch device information.
- B. Nominal System Voltage: 208 Y/120 V.
- C. Main-Bus Continuous: Refer to plans for size.

2.3 FABRICATION AND FEATURES

- A. Enclosure: Steel: NEMA 250, Type 3R.
- B. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard color, including undersurfaces treated with corrosion-resistant undercoating.
- C. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

- D. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.
- E. Bus Transition and Incoming Pull Sections: Complete switchboard shall be front and rear aligned.
- F. Buses and Connections: Three phase, four wire, unless otherwise indicated. Include the following features:
 - 1. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Buses shall be current density rated.
 - 2. Main Phase Buses and Vertical Section Buses: Vertical buses shall be equal to main.
 - 3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
 - 4. Load Terminals: Insulated, rigidly braced, silver-plated, copper runback bus extensions equipped with pressure connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full ampere rating of circuit-breaker position.
 - 5. Ground Bus: 1/4-by-2-inch (6-by-50-mm) minimum size, drawn-temper copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - 6. Contact Surfaces of Buses: Silver plated.
 - 7. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions at ends.
 - 8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
 - 9. Neutral Buses: 100 percent of the ampacity of the phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables.
- G. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of compartment.

2.4 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic Trip Unit Circuit Breakers (main SES circuit breaker): RMS sensing; field-replaceable rating plug; with the following field-adjustable settings.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical or Compression style, suitable for number, size, trip ratings, and material of conductors.
- C. Fusible Switches.
 - 1. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

2. Lugs shall be front removable and UL Listed for 75° C copper conductors.
3. All current carrying parts shall be plated to resist corrosion.
4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
5. Switches shall have provisions for a field installable electrical interlock.
6. Switch operating mechanism shall be quick-make, quick-break 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 or opening action of the contacts has started.
7. The operating handle shall be an integral part of the box, not the cover.
8. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
9. The handle position shall travel at least 90 □ between OF
distinguish and indicate handle position.
10. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
11. Switches shall be horsepower rated for alternating current.
12. The UL Listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R or Class J or Class L fuses.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Support switchboards on concrete bases, minimum 4-inch (100-mm) nominal thickness.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

- A. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Provide hi-pot testing by independent testing agency for each switchboard bus, component, connecting supply and feeder.
 - 2. Test continuity of each circuit.
- B. Testing Agency: Engage a qualified independent testing agency to perform specified testing.
- C. Testing: After installing switchboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

- A. Coordination Study: Manufacturer or Contractor shall provide full coordination study.
- B. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

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 load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RMS: Root mean square.
- D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

- A. Keys: Two spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. Siemens Energy and Automation, Inc.
 - c. Square D.

2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. **HINGED FRONT COVER: ENTIRE FRONT TRIM HINGED TO BOX AND WITH STANDARD DOOR WITHIN PIANO-HINGED TRIM COVER.**
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.

- G. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Isolated Equipment Ground Bus: Where indicated on drawings. Adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Extra-Capacity Neutral Bus: Where indicated on drawings. Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- L. Feed-through Lugs: Where indicated on drawings. Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Where indicated on drawings. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LOAD CENTERS

- A. Not Acceptable.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch overcurrent protective devices shall be one of the following:
 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers where individual positive-locking device requires mechanical release for removal.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
 - 3. AFCI Circuit Breakers: Provide manufacturer's standard Arc Fault Circuit Interrupter circuit breaker in residential sleeping units.

- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Compression style, suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Shunt Trip: 120-V trip coil energized from separate circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 76 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Circuit Directory: Create a directory for each panelboard. Use a computer or typewriter to create directory cards; handwritten directories are not acceptable. Directory card shall include date, panelboard designation, load descriptions and/or room numbers.
- E. Install filler plates in unused spaces.
- F. Provision for Future Circuits at Flush Panelboards: Stub six 3/4-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Panelboard Nameplates: Label each panelboard with engraved metal nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486.

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

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. Single and duplex receptacles, ground-fault circuit interrupters, and isolated-ground receptacles.
 - 2. Single- and double-pole snap switches and dimmer switches.
 - 3. Device wall plates.
 - 4. Floor service outlets, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.
- B. Coordinate service pole connection requirements to modular furniture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wiring Devices:
 - a. Hubbell
 - b. Eagle
 - c. Leviton Mfg. Company Inc.
 2. Multioutlet Assemblies:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Wiremold Company (The).
 3. Telephone/Power Poles:
 - a. Hubbell
 - b. Thomas & Betts Corporation.
 - c. Wiremold Company (The).

2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
- B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.
- C. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
- D. Isolated-Ground Receptacles: Straight blade, Heavy-Duty grade, duplex receptacle, with equipment grounding contacts connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap.
1. Devices: Listed and labeled as isolated-ground receptacles.
 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 PENDANT RECEPTACLES

- A. Description: Industrial Cord Reel size and type as called out on electrical and/or architectural plans.

2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches: Heavy-Duty grade, quiet type.
- C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
 - 1. Control: Continuously adjustable slider with single-pole or three-way switching to suit connections.
 - 2. LED Lamp Dimmers: Dimmers shall be compatible with LED diver/fixture.

2.6 OCCUPANCY SENSORS

- A. Manufacturer and types as noted on plans.

2.7 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Stainless steel.
 - 3. Material for Unfinished Spaces: Stainless steel or nylon.
 - 4. Material for Wet Locations: Taymac (or equal), recessed weather proof receptacle cover that is weatherproof with plug inserted and compliance to 2002 NEC 406.8 (B) (1).

2.8 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush or flap type (refer to plans), dual-service units suitable for wiring method used. Refer to drawing for final device type model or series number.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, solid brass with satin finish (verify with Architect). Refer to drawings for final device type model or series number.
- D. Floor Boxes Ground Floor: Manufacturer and type(s) as noted on plans.

- E. Power Receptacle: NEMA WD 6, Configuration 5-20R, finish per Architect, unless otherwise indicated.
- F. Voice and Data Communication Outlet: bushed cable opening. Refer to CITY OF BUCKEYE IT TECHNICAL SPECIFICATIONS FOR WIRING AND COVER PLATE.

2.9 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: Per plans.

2.10 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 - 1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 - 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 - 3. Finishes: Per architectural specification.
 - 4. Wiring: Sized for minimum of eight No. 10 AWG power and ground conductors; and a minimum of twelve, 4-pair, Category 5e voice and data communication cables.
 - 5. Voice and Data Communication Outlets: Blank insert with bushed cable opening.

2.11 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.
 - 2. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods."
 - 1. Label all switches, receptacles, junction boxes, panelboards and disconnect switches.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

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 cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.4 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (4.4 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but not fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.; Busmann Div.
 - 2. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK1, time delay.
- B. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating and fuse part number information are readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 32 13

ENGINE/GENERATOR SET

PART 1.0 - GENERAL

1.1. DESCRIPTION:

- A. This section of the specification includes the furnishing, installation, connection and testing of the engine/generator, controller and associated equipment.
- B. The engine/generator shall comply with requirements as stated below.
- C. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein.

1.2. SCOPE:

- A. A new engine/generator with weatherproof housing, silencer, fuel tank, annunciator, controller, output circuit breaker and associated equipment shall be installed in accordance with the project specifications and drawings.

1.3. SUBMITTALS

A. General:

- 1. Six copies of all shop drawings and submittals shall be submitted to the Architect/Engineer for review.
- 2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
- 3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

- 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- 2. Include manufacturer's name(s), model numbers, ratings, requirements, equipment layout, device arrangement, wiring diagrams, battery information, charger information, jacket water heater information, annunciator information, conduit layouts and any other pertinent information affecting layout of equipment and installation.
- 3. Show annunciator layout, configurations, and terminations.
- 4. All shop drawings shall be submitted to the Town of Queen Creek for review and approval. Include all permit costs.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

1.4. GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5. POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the engine/generator shall be available from a factory trained authorized representative of the manufacturer of the equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period.
- C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance.

1.6. CODES AND STANDARDS

- A. The generator set shall conform to the requirements of the following codes and standards:
 - i) CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - ii) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - iii) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - iv) IEC8528 part 4. Control Systems for Generator Sets
 - v) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 - vi) IEEE446 – Recommended Practice for Emergency Power Systems for Commercial Applications.
 - vii) NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Articles 445, 700, 701, and 702.
 - viii) NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
 - ix) UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed

- x) EPA Compliance: Comply with all local applicable emissions control standards
 - (1) The engine shall be EPA Tier 3 certified for 2007

1.7 TESTING

- A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - i) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests.
 - (2) Maximum power (kW).
 - (3) Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 - (4) Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.40.
 - (5) Governor speed regulation under steady-state and transient conditions.
 - (6) Voltage regulation and generator transient response.
 - (7) Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - (8) Three-phase short circuit tests.
 - (9) Alternator cooling air flow.
 - (10) Torsional analysis to verify that the generator set is free of harmful torsional stresses.
 - (11) Endurance testing.
- B. Production Tests
 - xi) Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - xii) Single-step load pickup.
 - xiii) Transient and steady—state governing.
 - xiv) Safety shutdown device testing.
 - xv) Voltage regulation.
 - xvi) Rated Power @ 0.8 PF
 - xvii) Maximum Power.
 - xviii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.
- C. Site Tests
 - xix) Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
 - (1) Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - (2) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, alternator strip heaters, remote annunciator, etc.
 - (3) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.

- (4) Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator set to the nameplate kW rating.
- (5) On-site Testing Requirements
 - (a) The engine-generator shall be run continuously for not less than 4 hours at 100% rated load with a load bank. The following readings shall be performed at 15 minute intervals:
 - (i) Engine oil temperature
 - (ii) Coolant temperature
 - (iii) Outdoor temperature
 - (iv) Generator voltage phase-to-phase and phase-to-neutral
 - (v) Amperage, each phase
 - (vi) Frequency
 - (vii) Automatic transfer and manual retransfer 2 complete operations (minimum)
 - (viii) Remote starting of generator, transfer, and retransfer 2 complete operations (minimum).

2) WARRANTY AND MAINTENANCE

- a) A one year warranty for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. The engine/generator warranty shall complement and supplement the automatic transfer switch warranty to provide owner with comprehensive warranty coverage of the emergency generation system equipment as a whole. Optional warranties shall be available upon request.
- b) The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

3) EQUIPMENT

- a) Acceptable Engine/Generator Manufacturers
 - i) Generac, Kohler Power Systems, CAT Power Systems, Onan-Cummins.
- b) The generator set shall be a Kohler model 250REOZJE with a 4UA10 alternator. It shall provide 312.50 kVA and 250.00 kW when operating at 120/208 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 122 °F and a maximum elevation of 2000 ft above sea level. The standby rating shall be available for the duration of the outage.

- 4) Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base

5) ENGINE

- a) The minimum 9 liter displacement engine shall deliver a minimum of 385 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
 - i) Electronic isochronous governor capable of 0.25% steady-state frequency regulation
 - ii) 24-volt positive-engagement solenoid shift-starting motor
 - iii) 60-ampere automatic battery charging alternator with a solid-state voltage regulation

- iv) Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
 - v) Dry-type replaceable air cleaner elements for normal applications
 - vi) Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel
 - vii) The turbocharged engine shall be fueled by diesel
 - viii) The engine shall have a minimum of 6 cylinders and be liquid-cooled
 - ix) The engine shall be EPA certified from the factory
 - x) The generator must accept rated load in one-step.
- b) EPA Compliance: Comply with all local applicable emissions control standards

6) ALTERNATOR

- a) The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator capable of maintaining voltage within $\pm 0.25\%$ at any constant load from 0% to 100% of rating with $< 0.5\%$ drift due to temperature variation. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
- b) The alternator shall have dual maintenance-free bearings, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
- c) The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
- d) Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 590.00 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

7) FUEL STORAGE SYSTEM

- a) Double Wall Secondary Containment Sub-base Fuel Tank
- b) The generator set shall be supplied with a sub-base fuel tank of sufficient capacity to hold 12-hour run time of diesel fuel at 100% load.
- c) The sub-base fuel system shall be listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
- d) The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
- e) Exterior Finish. The sub-base tank exterior finish shall be Power Armor Plus™, a polyurea-textured rubberized coating.

- f) Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
 - g) The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank.
 - h) There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.
 - i) A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed, vacuum tested dial, to eliminate fogging, shall be provided.
 - j) A float switch for remote or local annunciation of a (50% standard) low fuel level condition shall be supplied.
 - k) Fuel fill option – The fuel fill is equipped 5 gallon containment pan to catch leaks during filling and the fuel fill is extended to within 6" of the bottom of the fuel tank.
- 8) CONTROLLER
- a) Decision-Maker® 3000 Generator Set Controller
 - i) The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring, and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware, and software.
 - ii) The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.
 - b) Codes and Standards
 - i) The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.
 - ii) The controller shall meet NFPA 99 and NEC requirements.
 - iii) The controller shall be UL 508 listed.
 - c) Applicability
 - i) The controller shall be a standard offering in the manufacturer's controller product line.
 - ii) The controller shall support 12-volt and 24volt starting systems.
 - iii) The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
 - iv) The controller shall mount on the generator or remotely within 40 feet with viewable access.
 - d) Controller Buttons, Display and Components
 - i) The generator set controller shall include the following features and functions:
 - (1) Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:
 - (a) Run Mode: When in the run mode the generator set shall start as directed by the operator.
 - (b) Off/Reset Mode: When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.
 - (c) Auto Mode: When in Auto the mode the generator set shall be ready to accept a signal from a remote device.
 - ii) Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
 - iii) Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 characters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running, the display shall scroll all-important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall

- asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
- iv) Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
 - v) Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
 - vi) Alarm Silence/Lamp Test Button. When this button is depressed, it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
 - vii) USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
 - viii) Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2-wire star for transfer switch and auxiliary shutdown.
 - ix) The controller shall have auto resettable circuit protection integral on the circuit board.
- e) System Controller Monitoring and Status Features and Functions
- i) The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:
 - (1) Overview menu
 - (a) Active shutdowns and warnings shall be displayed if present and without the need of operator interface
 - (b) Engine runtime with total hours
 - (c) Average line to line voltage
 - (d) Coolant temperature
 - (e) Fuel level or pressure
 - (f) Oil pressure
 - (g) Battery voltage
 - (h) Software version
 - (i) Frequency
 - (j) Average current
 - (2) Engine metering menu.
 - (a) Engine speed
 - (b) Oil pressure
 - (c) Coolant temperature
 - (d) Battery voltage
 - (3) Generator metering menu.
 - (a) Total power in VA
 - (b) Total power in W
 - (c) Rated power % used
 - (d) Voltage L-L and L-N for all phases
 - (e) Current L1, L2, L3
 - (f) Frequency
 - (4) Generator set information.
 - (a) Generator set model number
 - (b) Generator set serial number
 - (c) Controller set number
 - (5) Generator set run time.
 - (a) Engine run time total hours
 - (b) Engine loaded total hours
 - (c) Number of engine starts
 - (d) Total energy in kW
 - (6) Generator set system
 - (a) System voltage
 - (b) System frequency 50/60Hz

- (c) System phase, single/three phase
- (d) Power rating kW
- (e) Amperage rating
- (f) Power type standby/prime
- (g) Measurement units, metric/English units adjustable
- (h) Alarm silence, always or auto only
- (7) Generator set calibration, the following are adjustable at the controller.
 - (a) Voltage L-L and L-N all phases
 - (b) Current L1, L2, L3
 - (c) Reset all calibrations
- (8) Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller.
 - (a) Voltage Adjustable +/- 10%
- (9) Digital and Analog Inputs and outputs
 - (a) Displays settings and status
- (10) Event Log
 - (a) Stores event history, up to 1000 events
- f) Controller Engine control features and functions
 - i) Automatic restart - the controller has automatic restart feature that initiates the start routine and re-crank after a failed start attempt.
 - ii) Cyclic cranking - the controller shall have programmable cyclic cranking
 - iii) Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.
 - iv) The control system shall include time delays for engine start and cool down.
 - v) The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.
 - vi) The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring
- g) Controller Alternator control features and functions
 - i) Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.
 - ii) AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
 - iii) Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
 - iv) Power metering. The controller digitally displays power metering of kW and kVA.
- h) Other control features and functions
 - i) Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
 - ii) Historical data logging. The controller total number of generator set successful start shall be recorded and displayed.
 - iii) Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.
- i) Generator Set Warning, Shutdown Alarm and Status
 - i) The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown,

warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:

- (1) Engine functions
 - (a) Critical high fuel level (alarm)
 - (b) ECM communication loss (shutdown)
 - (c) ECM diagnostics (alarm & shutdown)
 - (d) Engine overspeed (shutdown)
 - (e) Engine start aid active
 - (f) Engine under speed (shutdown)
 - (g) Fuel tank leak (alarm & shutdown)
 - (h) High DC battery voltage (alarm)
 - (i) High coolant temperature (alarm & shutdown)
 - (j) High fuel level (alarm)
 - (k) Low DC battery voltage (alarm)
 - (l) Low coolant level (shutdown)
 - (m) Low coolant temperature (alarm)
 - (n) Low cranking voltage (alarm)
 - (o) Low engine oil level (alarm & shutdown)
 - (p) Low fuel level (alarm & shutdown)
 - (q) Low fuel pressure (alarm)
 - (r) Low oil pressure (alarm & shutdown)
 - (s) No coolant temperature signal (shutdown)
 - (t) No oil pressure signal (shutdown)
 - (u) Overcrank (shutdown)
 - (v) Speed sensor fault (alarm)
- (2) Generator functions
 - (a) AC sensing loss over & under current (alarm & shutdown)
 - (b) Alternator protection (shutdown)
 - (c) Ground fault input (alarm)
 - (d) kW overload (shutdown)
 - (e) Locked rotor (shutdown)
 - (f) Over-frequency (shutdown)
 - (g) Over AC voltage (shutdown)
 - (h) Under-frequency (shutdown)
 - (i) Under AC voltage (shutdown)
 - (j) Emergency stop (shutdown)
- (3) Other General functions
 - (a) Battery charger fault (alarm)
 - (b) Common fault (shutdown)
 - (c) Common warning (alarm)
 - (d) Master switch not in auto (alarm)
 - (e) Generator running
 - (f) Input/Output fault (alarm)
- (4) The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements that include several of the above along with; EPS supplying load, Master switch "not in auto", and contacts for local and remote common alarm

9) ACCESSORIES

- a) Main Line Circuit Breaker
 - i) Engine generator shall be equipped with the following a circuit breakers as shown on the electrical single line drawing installed in a Nema 1 enclosure. It shall operate both manually for normal switching function or automatically during overload or short circuit.
 - ii) A 100% rated line circuit breaker of 800 amperes, 800 amps sensor, 250 volt rated, molded case type, generator mounted.

- b) Engine block heater.
 - i) Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
- c) Generator Mounted Safe Guard Breaker
 - i) A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed. a field current-sensing breaker will not be acceptable.
- d) Sound Attenuated Weatherproof Enclosure
 - i) The engine generating set shall be factory installed in a sound attenuated weatherproof outdoor enclosure. The enclosure shall provide year round generating set protection against adverse weather and environmental conditions.
 - ii) The sound attenuated weatherproof enclosure shall be rated at 75DBA @ 23 feet (7 meters) with 1" insulation through with a perforated liner.
 - iii) The sound attenuated weatherproof enclosure shall be constructed or welded and bolted reinforced sheet steel, 14 gauge and 14 gauge floor plate. All metal parts shall be prime coated and finish painted.
 - iv) The enclosure assembly shall have fixed air intake louver with interior sound baffles.
 - v) The enclosure shall enclosure an interior mounted critical silencer with exhaust blankets.
 - vi) The enclosure assembly shall have a vertical discharge plenum.
 - vii) The Enclosure shall have) hinged doors on each side, located on the side of enclosure to allow for access to main line circuit breaker, and the rear of the enclosure shall allow easy access to engine generator and controls. All door handles shall be key lock design.
 - viii) Electrical Package: One (1) single phase, 120/208 volt branch circuit panel with main circuit breaker and with individual load breakers wired to engine block heater, battery charger and electrical receptacles package (2 electrical receptacle).
- e) Battery System
 - i) Each genset requires a BCI group 31 batteries which must meet the engine manufactures' specifications for the ambient conditions specified in Part 1 Project Conditions and shall comply with the NFPA requirements for engine cranking cycles. Each battery shall be rated according to SAE Standards J-537 with a minimum cold cranking amp of 950 amps and a minimum reserve capacity of 185 Minutes at 80F. The battery plates shall be constructed of a Calcium-Lead alloy to provide long waterless operation and extended battery life. The battery elements must be anchor-locked with full-frame grids and tight-packed commercial plates to resist the effects of vibration. The battery must contain a handle to aid in lifting and the case must be constructed of polypropylene to resist breakage and extend service life. Removable cell covers shall be provided to allow for checking of electrolyte specific gravity.
 - ii) Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- f) Exhaust Systems
 - i) The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).
 - (1) Silencer shall be mounted within the generator set enclosure
 - ii) Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.

g) Two flexible fuel lines rated at a minimum of 257°F and 100 psi ending in pipe thread.

10) REMOTE SERIAL ANNUNCIATOR

- a) Annunciator must meet the following specifications:
 - i) Operating temperature range: -20° to 70°C (-4° to 158°F)
 - ii) Storage temperature range: -40° to 85°C (-40° to 185°F)
 - iii) Humidity range: 5-95% noncondensing
 - iv) Enclosure: NEMA 2
 - v) Power supply: 12- or 24-VDC
 - vi) Power draw: 200 mA
- b) Standards:
 - i) NFPA 110, Level 1
 - ii) NFPA 99
 - iii) UL 508 Recognized
 - iv) CE Directive (Voltage and EMC)
 - v) EN61000-4-4 Fast Transient Immunity
- c) Hardware Requirements
 - i) Front panel--
 - ii) Up to (24) Light-emitting diode (LED) indicators for shutdowns, warnings (pre-alarms), and status
 - iii) Up to (19) Light-emitting diode (LED) indicators, an audible horn, an alarm silence button, and a lamp test button required by NFPA 110, Level 1.
 - iv) LEDs must be activated to indicate: shutdowns, warnings (pre-alarms), or status
 - v) Must have a minimum of (3) LED colors to define function
 - vi) Must have LEDs with blinking functions to indicate status
 - vii) LEDs required to activate for the following shutdown and/or warning conditions:

- (1) Overcrank
- (2) Low Coolant Temperature
- (3) High Engine Temperature
- (4) Low Oil Pressure
- (5) Overspeed
- (6) Emergency Stop
- (7) Low Fuel
- (8) Low Coolant Level
- (9) Not-In-Auto
- (10) High Battery Voltage
- (11) Low Battery Voltage
- (12) Battery Charger Failure
- (13) Common Fault

viii) LEDs required to activate upon the following status conditions:

- (1) Lamp test
- (2) Alarm silence
- (3) System ready
- (4) Generator running
- (5) Communications
- (6) EPS Supplying Load

- d) Up to (3) user-defined inputs shall each activate an LED and an audible horn for shutdowns, warnings, or status conditions.
- e) Annunciator shall have removable text inserts for assigning user-defined inputs, assigning generator identification, and replacement.
- f) Front panel of annunciator shall be a sealed membrane and shall be capable of both surface-mounting and flush-mounting.

- g) Network Communication
 - i) Provide an RS-485 connection at the annunciator from the generator controller. Maximum distance shall be 1220 m (4000 ft.) from the generator controller to the furthest annunciator.
 - ii) No other external wiring required, except power, to activate the LEDs and horn.
 - iii) Provide up to (4) annunciators per generator. Multiple annunciators shall communicate via RS-485 serial bus.
- h) Generator prealarm senders to provide signals for local and/or remote annunciation for engine conditions approaching critical/shutdown parameters.

END OF SECTION

SECTION 26 36 00

AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL REQUIREMENTS

- 1) Furnish and install an automatic transfer switches system(s) with 4-Pole/4-Wire - Switched Neutral (V), 800 Amps, 208 Volt-60Hz. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.
- 2) SUBMITTAL
 - a) The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.
- 3) CODES AND STANDARDS
 - a) UL 1008 - Standard for Transfer Switch Equipment
 - b) IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
 - c) NFPA 70 - National Electrical Code
 - d) NFPA 110 - Emergency and Standby Power Systems
 - e) NEMA Standard ICS 10-2005, Electromechanical AC Transfer Switch Equipment

PART 2 – PRODUCT

- 4) TESTING
 - a) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - i) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.
 - b) Production Tests
 - i) Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:
 - (1) The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.
 - (2) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
 - (3) The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.
 - ii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.
 - c) Site Tests

- i) Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

5) WARRANTY AND MAINTENANCE

- a) A one year warranty for the automatic transfer switch shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- b) The automatic transfer switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

6) ELECTRICAL REQUIREMENTS

- a) The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load.
- b) The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.
- c) The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Main operators shall include overcurrent disconnect devices; linear motors or gears shall not be acceptable.
- d) All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
- e) The switch shall be positively locked and unaffected by momentarily outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- f) All main contacts shall be silver composition. Switches shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
- g) Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- h) Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.
- i) For four pole switches with a switching neutral, where neutral conductors must be switched as shown on the plans, the contractor shall be provided with fully rated switched neutral transfer contacts. Overlapping neutral contacts may be used as an alternative.

7) EQUIPMENT

- a) The automatic transfer switch shall be manufactured by ASCO, Kohler, Russell. All components shall be heavy duty. Unit shall be Kohler model Standard Transition (KCS)/KCS-ACVC-0800S or equal.
- b) The transfer switch shall have the following characteristics:
 - i) 800 amp current rating

- ii) 4 Pole
- iii) 4 wire, 3 phase
- iv) 208 Volt-60Hz
- v) Switched Neutral
- vi) The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps
- c) The ATS shall be furnished in a NEMA 3R enclosure.
- d) The switch shall be a 600 volt class.
- e) Provide quantity and size of lugs as required for normal power and generator feeders shown on plans.

8) MECHANICAL REQUIREMENTS

- a) All main contacts shall be of silver alloy composition. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- b) The contact transfer time shall not exceed one-sixth of a second.
- c) All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.
- d) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

9) ENCLOSURE

- a) The ATS shall be furnished in a NEMA 3R enclosure.
- b) All standard door mounted switches and indicating LED's shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing and replacement., The panel shall be capable of having a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

10) TRANSFER SWITCH CONTROL SYSTEMS

- a) The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.
- b) The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
- c) The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:
 - i) Keypad pushbuttons:
 - (1) Start/end system test
 - (2) Set/end exercise
 - (3) End time delay
 - (4) Lamp test/service reset
 - ii) Light-emitting diode status indicators:
 - (1) Contactor Position: Normal, Off, Emergency
 - (2) Source Available: Normal, Emergency
 - (3) Service required: immediate, maintenance
 - (4) Not in automatic mode

- (5) Four stage time delay remaining
- (6) Exercise: load, no load, set/disabled
- (7) Test: load, no load
- (8) Load control active: peak shave, load shed, pre/post-transfer signal
- (9) In-phase monitor/Off delay active

d) Outputs:

- i) Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
- ii) Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC
- iii) One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

11) OPERATION

- a) Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored. Voltage on both normal and emergency sources and frequency on the emergency sources shall be adjustable with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

b) Parameter	c) Dropout/Trip	d) Pickup/Reset
e) Under voltage	f) 75 to 98%	g) 85 to 100%
h) Over voltage	i) 106 to 135%	j) 95 to 100% of trip
k) Under frequency	l) 95 to 99%	m) 80 to 95%
n) Over frequency	o) 101 to 115%	p) 105 to 120%
q) Voltage unbalance	r) 5 to 20%	s) 3 to 18%

- b) Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 70°C .
- c) An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.
- d) Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.

- e) The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
- f) The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
- g) Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

12) TIME DELAYS

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- a) An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.
- b) A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- c) A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- d) A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect and reconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal.

The controller shall also include the following built-in time delays for the following operations:

1. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source.
 2. 10 seconds to 15 minute time delay for a failure to synchronize on an in-phase operation.
- e) All time delays shall be adjustable in 1 second increments.

- f) All time delays shall be adjustable by using the display and keypad, with a remote device connected to the communications interface port or USB.
- g) Each time delay shall be identified and a dynamic countdown shall be shown on the display. Active time delays can be viewed with a remote device connected to the communications interface port or USB.

13) MONITORING, PROGRAMMING AND COMMUNICATIONS

- a) The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.
- b) The display shall provide for the test functions, allowed through password security. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.
- c) A contact closure shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- d) Auxiliary contacts shall be provided consisting of a minimum of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.
- e) LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- f) LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.
- g) A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
- h) Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
- i) Terminals shall be provided for a remote contact which opens to signal the ATS to

transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad, communications interface port or USB. A "not-in-auto" LED shall indicate anytime the controller is inhibiting transfer from occurring.

- j) An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled from the user interface, communications interface port or USB.
- k) A time based load control feature shall be available to allow the prioritized addition and removal of loads based during transfer. This feature may be enabled for either or both sources. The user shall be able to control up to nine loads with independent timing sequences for pre and post transfer delays in either direction of transfer.
- l) The controller shall provide 2 inputs for external controls that can be programmed from the following values:
 - Common fault
 - Remote test
 - Inhibit transfer
 - Low battery voltage
 - Peak shave
 - Time delay bypassLoad shed forced to OFF position (Programmed transition only)

The controller shall provide two from "C" contact outputs rated for up to 12A @ 240VAC or 2A @ 480VAC that can be programmed from the following values:

- | | |
|----------------------------------|------------------------------------|
| -Aux switch open | -Transfer switch aux contact fault |
| -Alarm silenced | -Alarm active |
| -I/O communication loss | -Contactor position |
| -Exercise active | -Test mode active |
| -Fail to transfer | -Fail to acquire standby source |
| -Source available | -Phase rotation error |
| -Not in automatic mode | -Common alarm |
| -In phase monitor sync | -Load bank control active |
| -Load control active | -Maintenance mode active |
| -Non-emergency transfer | -Fail to open/close |
| -Loss of phase | -Over/under voltage |
| -Over/under frequency | -Voltage unbalance |
| -Start signal | -Peak shave active |
| -Preferred source supplying load | -Standby source supplying load |

The controller shall be capable of expanding the number of inputs and outputs with additional modules.

- Optional input/output modules shall be furnished with mount on the inside of the enclosure to facilitate ease of connections.

- m) *Engine Exerciser* - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on the calendar mode. For each routine, the user shall be able to:
 1. Enable or disable the routine
 2. Enable or disable transfer of the load during routine.

3. Set the start time,
time of day,
time of week,
week of month (1st, 2nd, 3rd, 4th, alternate or every)
4. Set the duration of the run.
5. At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be display when the exercise is active. It shall be possible of ending the exercise event with a single button push.

- n) *Date and time* - The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
- o) *Systems Status* - The controller shall have a default display the following on:
1. System status
 2. Date, time and type of the next exercise event
 3. Average voltage of the preferred and standby sources

Scrolling through the displays shall indicate the following:

1. Line of line and lone to neutral voltages for both sources
2. Frequency of each source
3. Load current for each phase
4. Single or three phase operation
5. Type of transition
6. Preferred source
7. Commit or no commit modes of operation
8. Source/source mode
9. In phase monitor enable/disable
10. Phase rotation
11. Date and time

- p) *Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.*
- q) *Self Diagnostics* - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- r) *Communications Interface* - The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration). This module shall allow for seamless integration of existing or new communication transfer devices and generators.
- s) The transfer switch shall also be able to interface to 3rd party applications using

Modbus RTU open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.

- t) The controller shall contain a USB port for use with a software diagnostic application available to factory authorized personnel for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The application can also adjust parameters on the controller.

- u) *Data Logging* - The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be accessible via the communications interface port or USB.
 - 1. Event Logging
Data, date and time indication port or USB
 - 2. Statistical Data
Total number of transfers*
Total number of fail to transfers*
Total number of transfers due to preferred source failure*
Total number of minutes of operation*
Total number of minutes in the standby source*
Total number of minutes not in the preferred source*
Normal to emergency transfer time
Emergency to normal transfer time
System start date
Last maintenance date

*The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.

- v) *External DC Power Supply* - An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

14) TEST AND CERTIFICATIONS

- a) Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

- b) The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

15) SERVICE REPRESENTATION

- a) The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

- b) The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

END SECTION 26 36 00

SECTION 26 51 00
INTERIOR LIGHTING

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. Interior lighting fixtures with lamps and ballasts.
 - 2. Lighting fixtures mounted on exterior building surfaces
 - 3. Lighting control system.
 - 4. Exit lights.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for manual wall-box dimmers.
 - 2. Division 26 Section "Wiring Devices" for occupancy sensors.

1.3 DEFINITIONS

- A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.
- B. CRI: Color rendering index.
- C. CU: Coefficient of utilization.
- D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
 - 1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- E. RCR: Room cavity ratio.
- F. Driver - the power supply used to power LED luminaires, modules, or arrays.
- G. L70, L70, or L70% - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.
- H. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

- I. LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure

1.4 SUBMITTALS

- A. Product Data: Provide product data sheets for each type of lighting fixture scheduled, arranged in order of fixture designation. Partial submittals are not acceptable and will be rejected. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of fixture, including dimensions and verification of indicated parameters, including voltage and wattage.
 - 2. Emergency lighting unit battery and charger.
 - 3. Lamps.
 - 4. Lighting control system.
- B. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs and emergency lighting requirements for paths of egress.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Unit Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years.
- B. Special Warranty for Fluorescent Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
 2. Warranty Period for Electromagnetic Ballasts: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least two of each type.
 2. Battery and Charger Data: 10 percent for each emergency lighting unit type. Furnish at least two of each type.
 3. Ballasts: 1 for every 75 of each type and rating installed. Furnish at least two of each type.
- B. Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.

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. Products: Subject to compliance with requirements, provide the products specified or equal.

2.2 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- G. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- H. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is scheduled.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 LIGHTING FIXTURES

- A. Refer light fixture schedule on plans for fixture specification.
- B. LED LUMINAIRES
 - 1. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
 - a. Minimum Light Output.
 - b. Zonal Lumen Requirements.
 - c. Minimum Luminaire Efficacy.
 - d. Minimum CRI.
 - e. L70 Lumen Maintenance.
 - f. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
 - 2. Additional requirements:
 - a. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
 - b. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
 - c. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
 - d. Luminaire shall be mercury-free, lead-free, and RoHS compliant.

- e. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 - f. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
 - g. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
 - h. Driver shall have a rated life of 50,000 hours, minimum.
 - i. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
 - j. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
 - k. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
 - l. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
 - m. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
 - n. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
 - o. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 - p. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
 - q. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
 - r. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
 - s. All luminaires shall be provided with knockouts for conduit connections.
 - t. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
3. Provide all of the following data on submittals:
 - a. Delivered lumens
 - b. Input watts
 - c. Efficacy
 - d. Color rendering index.
 4. The failure of one LED shall not affect the operation of the remaining LEDs.
 5. Dimming:
 - a. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
 - b. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire

2.4 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

- A. General: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life and special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.6 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).
- E. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- G. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.7 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

2.8 LIGHTING CONTROL DEVICES

- A. Dimming Ballast Controls: Push button or sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.

2.9 SOURCE QUALITY CONTROL

- A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.
- B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings:
 - 1. Install a minimum of two independent ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
 - 2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 3. Install at least two independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Continuous Rows: Suspend from cable.
- D. Adjust aimable fixtures to provide required light intensities.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

3.4 PROGRAMMING AND INSTRUCTION.

- A. Provide initial programming of control system. Discuss programming with owner to determine optimum programming control for interior and exterior lighting.
- B. Provide one 4 hour training session for owner's representatives. Provide four instruction manuals for control system.

END OF SECTION 26 51 00

SECTION 26 56 00
EXTERIOR LIGHTING

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 exterior lighting units with luminaires, lamps, ballasts, poles/support structures, and accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.
 - 2. Division 26 Section "Lighting Control Equipment" for programmable lighting control systems, time switches, additional photoelectric relays, power relays, and contactors.

1.3 DEFINITIONS

- A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.
- B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.
- C. Driver - the power supply used to power LED luminaires, modules, or arrays.
- D. L70, or L70% - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.
- E. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Materials and dimensions of luminaires and poles.
 - 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.

3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 4. High-intensity-discharge luminaire ballasts.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - C. Submittal and Shop Drawing Requirements: Shop drawings and submittals shall be bound in 8½" by 11" notebook form. Sheets larger than notebook size shall be folded into notebook size. Include title sheet with project information, owner information, contractor information and supplier information. Shop drawing and submittal package shall contain complete submittal information. Incomplete submittals shall be cause for rejection.
 - D. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.
 - E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - F. Maintenance Data: For lighting units to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.
- D. FM Compliance: Units for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on fiberglass poles until just before pole installation. Handle poles with web fabric straps.
- D. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Special Warranty: Written warranty, signed by manufacturer and Installer agreeing to replace external parts of luminaires and poles exhibiting a failure of finish as specified below. This warranty is in addition to, and not a limitation of, other rights and remedies Owner may have under requirements of the Contract Documents.
 - 1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.
 - 2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation.
 - 3. Warranty Period: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least two of each type.
 - 2. Ballasts: 1 for every 75 of each type and rating installed. Furnish at least two of each type.
- B. Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedule on the drawings. Being listed in the Lighting Fixture Schedule does not exempt Fixtures compliance with this specification.

2.2 LUMINAIRES

- A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and

when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.

- F. Exposed Hardware Material: Stainless steel.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- J. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.
- K. LED LUMINAIRES
 - 1. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
 - a. Minimum Light Output.
 - b. Zonal Lumen Requirements.
 - c. Minimum Luminaire Efficacy.
 - d. Minimum CRI.
 - e. L70 Lumen Maintenance.
 - f. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
 - 2. Additional requirements:
 - a. Color Temperature of 3000K-4100K as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
 - b. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
 - c. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
 - d. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
 - e. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 - f. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
 - g. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
 - h. Driver shall have a rated life of 50,000 hours, minimum.
 - i. Lumen output shall not depreciate more than 20% after 10,000 hours of use.

- j. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
 - k. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
 - l. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
 - m. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
 - n. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
 - o. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 - p. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
 - q. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
 - r. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
 - s. All luminaires shall be provided with knockouts for conduit connections.
 - t. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
3. Provide all of the following data on submittals:
- a. Delivered lumens
 - b. Input watts
 - c. Efficacy
 - d. Color rendering index.

2.3 LUMINAIRE SUPPORT COMPONENTS

- A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
 - 1. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Will not cause galvanic action at contact points.
 - 2. Mountings: Correctly position luminaire to provide indicated light distribution.

3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
 4. Anchor-Bolt Template: Plywood or steel.
- E. Pole/Support Structure Bases: Anchor type with anchor bolts, leveling nuts, and bolt covers.
- F. Steel Poles: Tubing complying with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in length with access handhole in pole wall.
- G. Aluminum Poles: Fabricated from seamless, extruded structural tube complying with ASTM B 429, 6063-T6 alloy with access handhole in pole wall.
- H. Prestressed Concrete Poles: Centrifugally cast, hollow-shaft type. Cure with wet steam and age for a minimum of 15 days before installation. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.
- I. Aluminum Mast Arms: Tapered oval arms continuously welded to pole attachment plate with span and rise as indicated.
- J. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color selection by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete Foundations: Construct according to Division 3 Section "Cast-in-Place Concrete." Pole base diameter, height, burial depth and steel reinforcement shall be designed by an Arizona registered structural engineer as part of the requirements for this specification.
1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
 2. Finish for Parts Exposed to View: Trowel and rub smooth. Comply with Division 3 Section "Cast-in-Place Concrete" for exposed finish.
- B. Install poles as follows:
1. Use web fabric slings (not chain or cable) to raise and set poles.
 2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 3. Secure poles level, plumb, and square.
 4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space.
 5. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

- C. Luminaire Attachment: Fasten to indicated structural supports.
- D. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.
- E. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.2 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Ground metal poles/support structures according to Division 26 Section "Grounding."
 - 1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:
 - 1. Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards.
 - 2. Check intensity and uniformity of illumination.
 - 3. Check excessively noisy ballasts.
- E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.
- F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.4 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.
- B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

END OF SECTION 26 56 00

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1.0 - GENERAL

1.1. DESCRIPTION:

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- D. Furnish and install a complete Class "A", addressable fire alarm system as described herein and as shown on the Approved Plans. Fire detection system shall comply with 2002 NEC Article 760, 2002 NFPA, U.L. Inc., and 2002 NEC, 2003 IFC, 2003 IBC, and 2003 IMC, as adopted by the City of Mesa and shall meet ADA Standards and installation requirements.
- E. Acceptable manufactured systems shall be **Fire-Lite**, Kidde-Fenwal, EST, Simplex/Grinnell and Siemens. No substitutions outside of the foregoing list are permitted. All components of the system shall be the products from one manufacturer's system.
- F. Notwithstanding the foregoing listing of acceptable manufacturers, the contractor proposing to install the components of a particular manufacturer (from the approved list above) shall demonstrate that there is a minimum of three (3) fire alarm service companies located within 50-miles of Mesa, Arizona who can program, service and repair the fire alarm components and system of the proposed manufacturer. Each such fire alarm service company shall be authorized by the manufacturer to work on the manufacturer's system. The contractor shall demonstrate compliance with the requirements of this section by listing the three (3) fire alarm service companies with their contact information and a letter from the manufacturer as a required shop drawing submittal.
- G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.2. SCOPE:

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.
4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1.3. SUBMITTALS

A. General:

1. Six copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.
4. All shop drawings shall be submitted to the City of Surprise for review and approval. Include all permit costs. Submit plans as required by the City of Surprise.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.

E. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.4. GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5. POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled

maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period.

- C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
 - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
 - 2. Each circuit in the fire alarm system shall be tested semiannually.
 - 3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.6. APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

- A. National Fire Protection Association (NFPA) - USA:
 - No. 13 Sprinkler Systems
 - No. 72 National Fire Alarm Code
 - No. 101 Life Safety Code
- B. Underwriters Laboratories Inc. (UL) - USA:
 - No. 268 Smoke Detectors for Fire Protective Signaling Systems
 - No. 864 Control Units for Fire Protective Signaling Systems
 - No. 268A Smoke Detectors for Duct Applications
 - No. 521 Heat Detectors for Fire Protective Signaling Systems
 - No. 464 Audible Signaling Appliances
 - No. 38 Manually Actuated Signaling Boxes
 - No. 346 Waterflow Indicators for Fire Protective Signaling Systems
 - No. 1971 Visual Notification Appliances
- C. Local and State Building Codes.
- D. All requirements of the Authority Having Jurisdiction (AHJ).

1.8. APPROVALS:

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - UL Underwriters Laboratories Inc
- B. The fire alarm control panel shall meet UL Standard 864 (Control Units).

PART 2.0 PRODUCTS

2.1. EQUIPMENT AND MATERIAL, GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2. CONDUIT AND WIRE:

A. Conduit:

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- 2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
- 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
- 6. Conduit shall be 1/2-inch (19.1 mm) minimum.

B. Wire:

- 1. All fire alarm system wiring shall be new.
- 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
- 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
 5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
 6. All field wiring shall be electrically supervised for open circuit and ground fault.
 7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.
- C. Terminal Boxes, Junction Boxes and Cabinets:
- All boxes and cabinets shall be UL listed for their use and purpose.
- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3. MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

- A. Acceptable manufactured systems shall be Fire-Lite, Kidde-Fenwal, EST, Simplex/Grinnell and Siemens. No substitutions outside of the foregoing list are permitted. All components of the system shall be the products from one manufacturer's system. Main FACP shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. Operator Control
1. Acknowledge Switch.
 2. Alarm Silence Switch.
 3. Alarm Activate (Drill) Switch.
 4. System Reset Switch.
 5. Lamp Test.
- C. System Capacity and General Operation
1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.

2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) programmable Notification Appliance Circuits.
3. The control panel or each network node shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style Z) or Class B (NFPA Style Y) per the project drawings.
4. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
5. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
6. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
7. The FACP or each network node shall provide the following features:
 - a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
 - c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
 - e. The ability to display or print system reports.
 - f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
 - g. PAS presignal, meeting NFPA 72 3-8.3 requirements.
 - h. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 Chapter 1 requirements for activation of notification circuits within 10 seconds of initiating device activation.
 - i. Periodic detector test, conducted automatically by the software.

j. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

l. Walk test, with a check for two detectors set to same address.

m. Control-by-time for non-fire operations, with holiday schedules.

n. Day/night automatic adjustment of detector sensitivity.

o. Device blink control for sleeping areas.

8. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM) and Temporal (NFPA 72 A-2-2.2.2). Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall

also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

E. System Display

1. The system shall support the following display mode options:
 - a. 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
2. The display shall provide all the controls and indicators used by the system operator:
 - a. The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes.
 - a. The 80-character display shall provide 8 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, and ALARM SILENCED.
 - b. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

F. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for

automatic detector testing and for the automatic determination of detector maintenance requirements.

G. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
 - a. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
 - b. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

H. Notification Appliance Circuit (NAC) Module

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.
4. The module shall provide eight green ON/OFF LEDs and eight yellow trouble LEDs.
5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

I. Control Relay Module

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
3. The relay module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs (indicates disabled status of the relay).
4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.

5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.
6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

J. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

K. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 60 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - Ground Fault LED
 - AC Power Fail LED
 - NAC on LED (4)
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 60 AH.
7. All circuits shall be power-limited, per UL864 requirements.

L. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
10. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
11. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

12. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
 13. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
 14. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
 15. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.
- M. Field Charging Power Supply (FCPS): The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
 2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
 3. The FCPS shall include an attractive surface mount backbox.
 4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
 5. The FCPS include power limited circuitry, per 1995 UL standards.
- N. Specific System Operations
1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
 2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
 3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
 4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status
 - b. Device type

- c. Custom device label
 - d. View analog detector values
 - e. Device zone assignments
 - f. All program parameters
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
 6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
 7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
 8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
 9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
 10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
 - a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
 - b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
 - c. All devices tested in walk test shall be recorded in the history buffer.
 11. Waterflow Operation

An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
 12. Supervisory Operation

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

13. Signal Silence Operation

The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

14. Non-Alarm Input Operation

Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

15. Combo Zone

A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4. SYSTEM COMPONENTS:

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as shown on plans.

B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

C. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

D. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.

3. An audible indication of alarm shall be integral to the alphanumeric display.
 4. The display shall be UL listed for fire alarm application.
 5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
 6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
 7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a keyswitch or password.
- E. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.
- F. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.
1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
 2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
 3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
 4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
 5. Communication shall include vital system status such as:
 - Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - Independent Addressable Device Status
 - AC (Mains) Power Loss
 - Low Battery and Earth Fault
 - System Off Normal
 - 12 and 24 Hour Test Signal
 - Abnormal Test Signal (per UL requirements)
 - EIA-485 Communications Failure
 - Phone Line Failure
 6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

G. Field Wiring Terminal Blocks

For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in

the FACP program and allowing the system operator to view the current analog value of each detector.

11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

E. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

F. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the

rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

G. Four Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 4-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

2.6. BATTERIES:

- A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 28 31 00

SECTION 28 40 00

FIRE STATION DISPATCH INFRASTRUCTURE

Section 27200, Rev. F 9/24/2010

US Digital Designs Phoenix G2 Fire Station Alerting System

1.00 Overview

This specification is for a Fire Station Alerting system to be installed in one or more fire stations. This new system shall be a US Digital Designs "Phoenix G2" system or equal. It shall be capable of interfacing to, and receiving alerts from a data network, radio network, and two-tone paging system. The system shall be based on standard EIA/TIA 568-B Category 5 data network cabling and shall be installable by a low voltage cabling contractor. The alerting system shall accommodate connections to systems such as lighting control, telephone paging, voice radios, doorbell buttons, and other devices. These systems and their installation will be specified in other sections and provided by the owner or other trades.

1.01 Section Includes:

Fire Station Alerting system equipment with Fire Station Controller along with an optional expansion unit installed in a central location and peripherals consisting of Room Remotes, Message Remotes and message signs, Turnout Timers and audio speakers located throughout the Fire Station.

1.02 References

- A. Underwriter's Laboratories UL-1069.
- B. Electronics Industry Association / Telecommunications Industry Association.
- C. National Electrical Code.
- D. U.S. Dept. of Labor / Occupational Safety and Health Administration.
- E. National Fire Protection Association 1221.

1.03 Qualifications

- A. Certified low-voltage system installer.
- B. Applicable state licenses.
- C. Certificate of successful completion of manufacturer's installation/training school for the equipment being proposed.

1.04 Related Work Provided in Other Specification Sections

- A. Unless noted otherwise, the following work is to be provided under other specification sections:
 1. Installation of conduits, raceways and electrical junction boxes.
 2. 120 VAC power wiring and outlets.
 3. Overhead lighting.
 4. Rough openings and framing for equipment cabinets and Room Remotes.

1.05 System Description

- A. System hardware shall consist of a Station Alerting Controller and multiple peripheral units. These peripherals shall be one or more Message Remotes with BetaBrite message signs; Room Remotes and Turnout Timers. System speakers shall be Bogen S86 or equivalent speakers for non-lighted applications, US Digital Designs Jupiter low-voltage lighted speakers for lighted applications, and Bogen NEAR A2 speakers for apparatus bay and outside applications.
- B. All necessary equipment required meeting the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating fire station alerting system.
- C. System firmware shall be the product of the station alerting system manufacturer with sole control over revisions and/or changes. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of one year from date of installation for any product feature enhancements. System firmware upgrades shall not require any exchange of parts and

shall be capable of being executed via a laptop computer connection, a web browser, and the SSL protocol.

1.06 Submittals

- A. Any supplying contractor proposing equipment which is not the base standard for this specification, must provide full submittals at the time of bid. This option shall be exercised at the discretion of the owner/specifying authority.
- B. In the event the specifying authority decides to reject the submittals of a supplying contractor, the specifying authority may ask the contractor to re-submit if the discrepancies are minor. Otherwise rejection of submittals means the specified product must be supplied.

Part 2—Products

2.01 Manufacturers

The products specified shall be new and of the standard manufacture of a single reputable manufacturer. As a reference of standard and quality, functionality and operation, it is the request of the owner that bids be based only on equipment manufactured by US Digital Designs, Tempe, Arizona.

2.02 Cabling

Cabling shall be in strict accordance with local codes and to the cable specifications found in the manufacturer's installation manual.

All peripheral network cabling shall be ANSI/EIA/TIA-568-B Category 5 UTP plenum rated cable run as shown on drawings. Cable jacket shall be YELLOW in color. Certification documents shall be provided for all cabling runs.

Message Remote to BetaBrite message sign data cable shall be flat grey 6 conductor telephone device cable with 6 conductor modular plugs attached on both ends. Wiring shall be straight through.

All speaker cabling shall be 18 gauge, 2 conductor stranded jacketed cable for speakers only and 18 gauge, 4 conductor stranded jacketed cable for Jupiter speaker lights. Optionally, contractors can run two 18 gauge, 2 conductor cables for Jupiter speaker lights.

2.03 Fire Station Controller Equipment

Furnish a Phoenix G2 Fire Station Alerting Controller mounted in a 19" rack cabinet located in a central location. Each unit shall have the following equipment factory installed and interconnected:

- A. Fire Station Controller.
- B. Audio Tone Unit – ATU.
- C. 24 Port Ethernet Switch.
- D. 24 Port Power Audio Ethernet Mixer.
- E. Uninterruptible Power Supply.
- F. Cabling Patch Panel.
- F. Radio Mounting Bracket.

2.04 Message Remotes

Furnish as shown on plans, Message Remotes capable of the following functions:

- A. Dual Message Sign control.
- B. Independently Controlled Dual 15 Watt Audio Amplifiers.
- C. Lighting Control.
- D. Panel or wall-mountable.
- E. Single cable connection.

2.05 Double-Sided Message Remotes

Furnish as shown on plans, Double-Sided Message Remotes w/ 2 Beta-Brite signs attached capable of the following functions:

- A. Dual Message Sign control.
- B. Independently Controlled Dual 15 Watt Audio Amplifiers.

- C. Lighting Control.
- D. Cantilever support with attached mounting bracket.
- E. Single cable connection.

2.06 Room Remotes

Furnish as shown on plans, Room Remotes capable of the following functions:

- A. Integrated Message Display.
- B. 15 Watt Audio Amplifier.
- C. Lighting Control.
- D. Flush or surface mountable.
- E. Single cable connection.

2.07 Turnout Timers

Furnish as shown on plans, Turnout Timers capable of the following functions:

- A. 2.25" LED Digit Display
- B. Count up display showing Minutes and Seconds elapsed during alert
- C. Dry Contact triggers to start/stop and reset counter

2.08 Speaker Systems

Speaker systems shall be either 8 ohm or 70 volt, as per design documents. Speakers shall be grouped into "areas" of similar sound level and unit alerting requirements.

2.09 Hallway / Room Speakers

Speakers may be provided by Alerting System manufacturer, or contractor. Check with System manufacturer for details.

Speakers shall be Bogen S86T725PG8W or as called out on plans.

For suspended ceiling applications, provide appropriate speaker support tile bridge. For hard ceiling applications provide appropriate speaker back box.

2.10 Apparatus Room and Outdoor Speakers

Provide as shown on plans, Bogen Communications NEAR A2 loudspeakers.

2.11 LED Lighted Speakers

Provide Jupiter low-voltage LED lighted speakers as noted on drawings. This low-voltage lighting shall be 48 VDC and operated by dry contact closure.

2.12 System Diagnostics

- A. All active components in the system shall be continuously supervised for both power and data to ensure proper operation and in the case of system faults to aid in troubleshooting.
- B. All faults shall be displayed immediately on the associated Communications Gateway.

Part 3—Execution

3.01 Supervision

Only factory trained installers shall install, service, and maintain the specified system.

3.02 Rough Openings

- A. Phoenix G2 Station Alerting Controller Cabinet – The rough opening for the Station Alerting Controller rack cabinet shall be 84 1/2" H x 26" W.
- B. Room Remote – The flush mount Room Remote rough opening shall be 5 1/2" H x 13 1/2" W. Maximum high side reach allowed shall be 64" AFF, typical height shall be +48" AFF.
- C. Provide access hatches in finished drywall ceiling areas where access is restricted to devices mounted above ceiling.

3.03 Wiring

- A. All peripheral network cables terminate on patch panel located in the Station Controller Cabinet and on a single telecommunications outlet on the peripheral end. Telecommunications Outlet jack shall be Panduit CJ5E88TGWH Mini-Com or equivalent.
- B. All speaker cabling shall be 18 gauge, 2 conductor stranded, jacketed cable for speakers only and 18 gauge, 4 conductor stranded jacketed cable for Jupiter speaker lights. Optionally, contractors can run two 18 gauge, 2 conductor cables for Jupiter speaker lights.
- C. Contractor shall terminate all four (4) pairs of Category 5 cable on manufacturer-approved connectors, and shall test and certify all connections to 100MHz. Provide all cabling test certifications after testing.
- D. All wiring shall be free from shorts and faults. Wiring shall be UL listed, NEC and NFPA 70, Article 25 approved.
- E. Terminate all network cabling on approved patch panels. Label each jack panel with the room number of each terminating jack and the end of the corresponding cable with the jack panel number and jack number.
- F. Message Sign cabling to Message Remote shall be 6 conductor flat "silver satin" type cable or equivalent. Terminate both ends with 6 conductor modular plugs utilizing straight thru wiring (DO NOT turn over conductors). Message Sign to Message Remote cabling shall not be longer than 25 feet to observe proper serial operation.
- G. 8 ohm speakers shall have cabling run to nearest speaker, Message Remote, or Room Remote as noted on plans. 70 Volt speakers shall have cabling run to the nearest speaker, Message Remote with 70 volt transformer, or home run back to Station Controller cabinet as noted on plans.
- H. Label both ends of all network cabling and the Station Controller Cabinet end of all speaker and lighting cables. Label patch panels in the Station Controller location.

3.04 Outlet Boxes and Conduit

General – Provide pull string in all empty conduit installed in this section. Label conduit ends with conduit usage when practical.

- A. Message Remote – In suspended ceiling locations, provide 4" metal J-box with mud ring, as indicated, above finished ceiling. Stub up 3/4" empty conduit from each Message Remote J-box to nearest accessible ceiling, cable tray, or other location as shown. In hard ceiling locations, locate J-box at nearest accessible ceiling location.

Provide 4" metal J-box with duplex mud ring as indicated for each associated message sign at +7'6" AFF typical (+13' AFF for apparatus bay). Center J-box above doorways and align with other architectural features as directed. Orient mud ring opening horizontally. Provide 3/4" empty conduit between the Message Remote J-box and each of the associated message sign J-boxes (maximum of two). Provide duplex stainless steel J-box covers with 3/4" dia. hole centered in the cover with a Heyco #2840 bushing for all junction boxes.
- B. Double-sided Message Remote – Provide 4" metal J-box with mud ring, as indicated, on wall behind sign mounting location. Stub up 3/4" empty conduit from J-box to nearest accessible ceiling, cable tray, or other location as shown. Provide suitable mounting (3/4" plywood typical) behind drywall surface for mounting Double-sided Message Remote bracket. NOTE: The mounting bracket must support the entire weight of the Message Remote and attached signs.
- C. Room Remote – Provide 3/4" empty conduit from rough opening to nearest accessible ceiling, cable tray, or as shown on drawings. Rough opening to be located +48" AFF typical and no more than +64" AFF.
- D. Ceiling Speakers (Hard Ceiling) – Provide Bogen RE84 Ceiling Speaker Enclosures in all hard ceiling applications. Provide 3/4" empty conduit to enclosure and run to nearest accessible ceiling location, cable tray or equipment as shown. Conduit shall also be used to interconnect with other enclosures as shown on construction drawings.
- E. Ceiling Speakers (Suspended Ceiling) – Provide Bogen TB8 as appropriate for specified speakers. Provide RE84 ceiling speaker enclosures as required by specifying engineer or client.
- F. Apparatus Bay and Outside Speakers – Provide 4" metal J-box with mud ring and cover at each speaker location with 3/4" empty conduit to Message Remote or other location as indicated. Provide a 3/4" dia. hole centered in the J-box cover with a Heyco #2840 bushing to allow speaker

cable to run to speaker. Apparatus bay speakers are typically located +13' AFF, outside speakers are typically located +11' AFF. Other heights as noted on drawings.

3.05 Speakers

- A. Ceiling Speakers (Suspended Ceiling) – Install Bogen S86T725PG8W speakers through ceiling tiles and tile bridge per manufacturer's specifications. Connect speakers to Room Remotes and Message Remotes as shown. 8 ohm speaker systems require that the 70 volt transformer be bypassed by the installer. All 8 ohm speakers shall be installed using parallel or series/parallel connections with no less than 4 ohms impedance.
- B. Ceiling Speakers (Hard Ceiling) – Install Bogen S86T725PG8W speakers into enclosures and connect to Room Remotes or Message Remotes as shown.
- C. Apparatus Bay Speakers – Install Bogen NEAR A2 speakers to structure per manufacturer's specifications. Connect speakers to Message Remote amplifier via cable in conduit as shown. Dress cabling neatly to minimize visibility.
- D. Exterior Speakers – Install Bogen NEAR A2 speakers to structure per manufacturer's specifications. Connect speakers to correct Message Remote amplifier as shown. Provide Bogen model ASTB4 cable boot and install drip loop in cable prior to entry into J-box. Seal entry using appropriate sealant.

3.06 Equipment Mounting

All equipment mounted to drywall shall use appropriate fasteners and drywall anchors. Equipment shall not be directly screwed into drywall using unapproved fasteners such as drywall or wood screws.

3.07 Electrical Power Connections

- A. It shall be the responsibility of other trades to provide the appropriate number of dedicated 120 VAC, 20A duplex outlets into the equipment cabinet rough opening. This power feed shall not have any other devices connected directly to it and shall be labeled "Station Alerting". This electrical circuit shall be connected to the fire station's emergency power system for automatic power provision during loss of utility power.
- B. Provide single 120 VAC 15A outlet for each Turnout Timer location. Outlet shall be located to accept standard plug-in wall transformer.
- C. Connect all system power supplies and equipment cabinets to a common earth ground utilizing a 14 AWG, or larger, solid conductor which is at minimum the same conductor size as the AC feed wires.

3.08 Environmental Protection

Make certain that all central equipment is accessible for service. Contractor shall notify specifying authority if designated equipment closet does not meet manufacturer's requirements for heat, radiation or static electricity.

3.09 Connections to Other Equipment

- A. Lighting Controller (optional) – Connect low voltage dry contact lighting controls (provided by others) to Room Remote, Message Remote or ATU outputs. Low voltage outputs are non-inductive load, 24VDC 1A maximum. Provide an interposing relay or contactor between the low voltage output and any 120/277 VAC lighting or other load.
- B. Local Area Network (optional) - Connect the Fire Station Controller to the general purpose LAN (provided by others) located in the Fire Station. This connection shall be connected back to the central Communications Gateway to allow alerting commands to be sent from the Communications Gateway to the Fire Station Controller. In addition, the connection shall allow remote diagnostics and configuration.
- C. Radio System (optional) – Connect Audio Input #1 to the dispatch voice radio system (provided by others) as necessary to provide dispatch audio. This connection shall provide a 600 ohm impedance 0 dBm level signal.
- D. Telephone System Intercom (optional) – Connect Audio Input #3 to an Intercom output from the building telephone system (provided by others). This line shall be provided via a jack box located directly adjacent to the Station Alerting system equipment.

- E. Other Audio Source (optional) – Connect Audio Input #4 to an audio source (provided by others). This line shall be provided via a jack box located directly adjacent to the Station Alerting system equipment.
- F. Telephone System Ringdown (optional) – Connect the Ring Detector input to a telephone line (provided by others) for telephone ringing and backup alerting. This line shall be provided via a jack box located directly adjacent to the Station Alerting equipment.

3.10 Drawings

Provide as-built drawings of all installed components and associated wiring on building plans.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Site clearing, preparation and grading.
 - 2. Building excavating and backfilling.
 - 3. Trenching, backfilling and compacting for building and site utilities.
 - 4. Excavation and grading for site paving, curbs and sidewalks.
 - 5. Finish grading.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete: Subslab vapor retarder membrane.

1.02 DEFINITIONS

- A. Native or natural soils: Undisturbed soils present at site in their natural state or conditions. Materials which are essentially free of vegetation or organic matter and do not include trash or other deleterious materials.
- B. Existing fill soils: Materials present at site that have been disturbed, possibly transported, and are not in their natural undisturbed state.
- C. Imported fill soils: Materials transported onto site.
- D. Granular material: A sandy type of soil whose particles are coarser than cohesive material and which do not stick to each other.
- F. Finished Grade: Floor level for interior footings, and the lowest adjacent grade (either floor level or outside grade) within 5'-0" of foundations for perimeter wall or exterior column footings.
- G. Building Perimeter: The extreme outer edge of footing. This location of the building perimeter is to be used in determining the required lateral extent of engineered fill.
- H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.03 SUBMITTALS

- A. Test Reports:
 - 1. Submit test results for imported fill materials to be used (if required), directly to the testing laboratory with a copy to Architect in accordance with Section 01 45 00.
 - 2. Test results shall clearly indicate:
 - a. Types of materials and composition.
 - b. Hardness
 - c. Compactability.
 - d. Presence of organic contaminants, whether or not below EPA action levels.

- e. Presence of hazardous and/or regulated wastes and contaminants, whether or not below EPA action levels.
- f. Suitability for proposed usage.
3. Testing laboratory shall notify Architect of non-conforming fill material submittals.

B. As-Built Drawings:

1. Maintain previously recorded utilities and accurately record location of:
 - a. Newly encountered utilities remaining.
 - b. Rerouted utilities.
 - c. New utilities by horizontal dimensions, elevations or inverts, and slope gradients.
2. Submit in accordance with Section 01 77 00.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable Federal, State and local ordinances, including Arizona Highway Department Standard Specifications, City of Buckeye, and MAG Specifications. Where geotechnical report, General Structural Notes, or notes on drawings state more restrictive requirements, the requirements of the geotechnical report, General Structural Notes, or notes on drawings shall govern.
- B. Staking: Staking shall be performed by a Civil Engineer or Land Surveyor currently registered in the state where the Project is located. One person only shall be responsible for staking the Project, however, additional staff may be used (under direct supervision of responsible person) for larger projects.
- C. Observation of Geotechnical Engineer: Every phase of the earthwork shall be performed under observation and testing directed by the Geotechnical Engineer.

1.06 SITE CONDITIONS

- A. Soil Report:
 1. Soil Report (Report on Geotechnical Investigation) provided by the Owner for design of this Project was prepared by Speedie and Associates Geotechnical – Environmental – Materials Engineers; is included as Document 00 31 32 and is entitled: Report on Geotechnical Investigation, Buckeye Fire Station #705, SEC Tartesso Parkway & Allyson Avenue, Buckeye, Arizona; Speedie Project No. 190095SA dated February 13, 2019.
 2. Neither the Owner or Architect guarantees the accuracy of the report nor the continuity of the soil conditions indicated at boring locations.
 3. Portions of the soil report incorporated, either by reprint or reference, into these Specifications are those which relate to the quality of materials and workmanship and become a part of the Contract Documents. Quantities of excavation and fill materials shall be as indicated on Drawings, or as required by actual conditions as depicted by the soil borings presented in the Soil Report.
- B. Existing Conditions:
 1. Bidders are expected to visit the site to form their own conclusions as to the character of the Work under this Section.

- C. Environmental Requirements: Place, spread or roll fill materials during favorable weather conditions. When the Work is interrupted by rain, do not resume fill operations until evidence is furnished which establishes that moisture content and density of the previously placed fill are as specified.
1. Surface drainage: Provide and maintain positive surface drainage during excavation. Prevent infiltration of water into utility or foundation excavations from whatever sources as may exist.
 2. Dust control: Comply with requirements of governing authorities. Use whatever means necessary to control dust on and near the Work and on and near off-site borrow, storage and spoil areas, if such dust is caused by the Contractor's operations during performance of the Work, or if resulting from the conditions in which the Contractor leaves the site. Thoroughly moisten surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other Work on the site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Materials: In accordance with recommendations of the Report on Geotechnical Investigation.
- B. Under-Slab Fill: Aggregate Base (ABC) conforming with material requirements of MAG Section 702.
- C. Pipe Bedding Fill: Material used for pipe bedding shall comply with MAG Section 601.4.1
- D. Warning Tape:
1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.
 2. Provide detectable warning tape with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep for non-metallic utility pipes, conduit or other underground services outside of building line.
 3. Tape Colors: Provide tape colors to utilities as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam, and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify survey data. Stake out work and verify as to location and elevation. Carefully maintain bench marks, monuments, and other reference points; if disturbed or destroyed, replace as directed.
- B. Site Clearing: Strip and remove all vegetation, debris, rubble, obviously loose surface soils from the entire area to be occupied by proposed construction in accordance with recommendations of the Report on Geotechnical Investigation.

- C. Final grades shall allow for placement of 8 inches of non-expansive fill on the building pads.
- D. Subsoils shall be further over-excavated at least 2 feet below proposed footing bottom elevation, or existing grade, whichever is deeper, extending at least 5 feet beyond footing edges and door landings within all footing areas. The entire building pad does not require over-excavation provided footing lines can be accurately located during earthwork operations.
- E. The Geotechnical Engineer shall examine subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials and contact with required soil strata.
- F. Prior to placing structural fill below footing bottom elevation, exposed grade shall be scarified, moisture conditioned, and properly compacted in accordance with recommendations of the Report on Geotechnical Investigation.
- G. Pavement areas shall be scarified, moisture-conditioned, and properly compacted in a similar manner.
- H. All cut areas and areas above footing bottom elevation that are to receive floor slab only fill shall be scarified, moisture conditioned, and properly compacted in accordance with recommendations of the Report on Geotechnical Investigation.
- I. Existing Utilities:
 - 1. Identify known below grade utilities. Stake and flag locations.
 - 2. Identify and flag above grade utilities.
 - 3. Maintain, re-route, extend and protect as required existing utilities remaining which pass through Work area as indicated.
 - 4. Notify utility company to remove and relocate utilities obstructing the Work.
 - 5. Pay costs for this Work, except that covered by utility company.
- J. Unknown Utilities and Concealed Conditions:
 - 1. Upon discovery of unknown utility or concealed conditions which are unrecorded on the Contract Documents, discontinue affected Work and notify Architect in writing.
 - 2. Should additional work be required to remove, maintain, re-route, extend or protect unknown utilities or other conditions, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.

3.02 SUBGRADE

- A. Prepare subgrade at building areas to proper elevation to receive under-slab fill.
- B. Prepare subgrade at paved areas to proper elevation to receive base course materials. See Division 32 paving Sections.
- C. Grade as required to bring entire remainder of site to finished grade as indicated on drawings.

3.03 EXCAVATION - GENERAL

- A. Excavate for foundations and footings to provide vertical walls and corners square. Keep entire excavation free from loose material. Conform to dimensions and elevations indicated with allowances for erection of forms, shoring, waterproofing, and inspection of footings.

- B. Material to be excavated shall be non-classified and shall include earth or other materials encountered in excavating.
- C. The use of explosives will not be permitted.
- D. Drawings show predetermined elevations or depths for bottoms of footings. Should additional depth of excavation be necessary, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.
- E. Shore and brace excavations if necessary to prevent cave-ins. Remove shoring before backfilling is completed, but not until permanent supports are in place.
- F. If excavation is carried below depth indicated, backfill with properly placed and compacted fill material (material as specified) over properly prepared subgrade, or increase foundation depth as required without extra compensation.
- G. Remove excess excavated material from the grounds and legally dispose of same.
- H. Protect utility services uncovered by excavation.
 - 1. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.
 - 2. Accurately locate and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

3.04 EXCAVATION - UTILITIES

- A. Trenching:
 - 1. General:
 - a. Perform trenching required for the installation of items where the trenching is not specifically described in other Sections of these Specifications.
 - b. Excavate for underground utilities, including water, steam, condensate, natural gas pipe lines, fire protection lines, sewers, electrical lines, cables, ducts and other electrical items.
 - 2. Width:
 - a. Make trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.
 - b. Provide for a minimum net clearance of 6 inches and a maximum net clearance of 12 inches on each side of the barrel of the pipe and to allow the backfill to be placed and properly compacted. Exceptions to these clearances will occur at encasement or special construction.
 - 3. Depth:
 - a. Trench as required to provide the elevations shown on the Drawings.
 - b. Where elevations are not shown on the Drawings or specified in other sections of the specifications, trench to sufficient depth to give a minimum of 18" of fill above the top of the pipe, measured from the adjacent finished grade.
 - c. Where the bottom of excavation is found to be soft and cannot support the pipe, the depth shall be extended until solid bearing is reached. Backfill to pipe foundation grade with granular material or earthfill and thoroughly compact to assure a firm foundation for the pipe.
 - d. Where excavation is in rock, or caliche, cut to depth of at least 8 inches below pipe invert elevations.

4. Trench Bottoms:
 - a. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit.
 - b. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 - c. Remove stones and sharp objects to avoid point loading.
 - d. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - e. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 5. Do not disturb any portion of or remove support from a piping system that has thrust blocks or other constraints against movement while the system is in service.
 6. Correction of faulty grades: Where trench excavation is inadvertently carried below proper elevations, backfill with pipe bedding material and compact to provide a firm and unyielding subgrade or foundation without additional compensation.
 7. Trench bracing:
 - a. Properly brace and support trenches in accordance with requirements of governing authorities.
 - b. Brace, sheet, and support trench walls in such a manner that the ground alongside the excavation will not slide or settle, and that existing improvements of every kind, whether on public or private property, will be protected from damage.
 - c. Arrange bracing, sheeting, and shoring so as not to place stress on portions of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.
 8. Repairs and replacement: In the event of damage to such improvements, immediately make repairs and replacements necessary to the approval of the Architect without additional compensation.
 9. Removal of trench bracing: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.
 10. Grading and stockpiling trenched material: Control the stockpiling of trenched material in a manner to prevent water running into the excavations. Do not obstruct surface drainage, but provide means whereby storm water is diverted into existing gutters, other surface drains, or temporary drains.
- B. Crossing Protection
1. Provide adequate temporary crossover for pedestrian and vehicular traffic including guard rails, lamps and flags, as required by agencies having jurisdiction and as directed.
 2. Remove provisions for crossing protection when they are no longer needed.
- C. Underpinning: Where excavation work is required under or adjacent to existing footings, under-pin as required to prevent damaging existing construction.
- 3.05 FOUNDATION FOR PIPES
- A. General: Grade the trench bottoms to provide a smooth, firm, and stable foundation free from rockpoints throughout the length of the pipe.
- B. Foundation material: Place a minimum of 6" of the specified pipe bedding fill material in the bottom of the trench.

- C. Subsurface conditions: In areas where soft, unstable materials are encountered at the surface upon which cohesionless material is to be placed, remove the unstable material and replace it with material approved by the Architect. Make sufficient depth to develop a firm foundation for the item being installed.
- D. Overexcavation: If the need for such overexcavation has been occasioned by an act or failure to act on the part of the Contractor, make the overexcavation and replacement without additional compensation.
- E. Bearing: At each joint in pipe, recess the bottom of the trench as required into the firm foundation in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing of the pipe barrel on the firm foundation.
- F. Shaping: Accurately shape pipe subgrade and fit the bottom of the trench to the pipe shape. Use a drag template shaped to conform to the outer surface of the pipe if other methods do not produce satisfactory results.

3.06 BEDDING FOR PIPES

- A. General: Place the specified pipe bedding fill material in the trench, simultaneously on each side of the pipe for the full width of the trench, to a maximum depth of 3 feet and a minimum depth of one foot above the outside diameter of the pipe barrel. Water consolidation shall not be allowed
- B. Densification: Take special care to provide firm bedding support on the underside of the pipe and fittings for the full length of the pipe.
- C. Alternate bedding: Other bedding procedures and materials may be used if prior written approval has been obtained from the Civil Engineer through the Architect.

3.07 UNDER-SLAB FILL

- A. Place under-slab fill to the thickness and grade indicated, smooth and even, free of voids. Compact to specified density. Grade to a tolerance of 1/4 inch in 10 feet.

3.08 BACKFILLING - GENERAL

- A. After completion of the foundations, walls and other construction, and removal of forms, clean the excavations of trash and debris.
- B. Place the backfill symmetrically against each side of the walls to prevent eccentric loading. Place backfill in horizontal 6 inch (150mm) layers with the proper moisture content for the required degree of compaction.

3.09 BACKFILLING - UTILITIES

- A. Backfill pipe and conduit trenches in a manner to prevent disturbance to the pipes or conduits. Fill under and around pipes thoroughly to a point approximately 12 inches above the top of the pipe and compact. Backfill remainder of trench in 6 inch layers and compact.

- B. Backfill utility trenches in accordance with MAG Section 601.
 - 1. Delete references to compaction methods specified in paragraph 6.01.2.5 and 6.01.4.4 of MAG Section 601 and insert the following:
 - a. The compacted density of the trench backfill shall be 95% of ASTM D-1557 (Method A or D) with the percent of density adjusted to compensate for the rock content larger than that which will pass a #4 sieve, by the method provided in the City of Phoenix Chart, Detail No. 35.
 - b. At least one density and moisture content test shall be taken in per 500 lineal feet of trench backfill per layer of backfill. The test must be made prior to any additional formation of backfill
 - 2. Revise paragraph 6.01.4.3, Backfill, as follows: "All backfill shall be granular material. Water settling is not permitted. Backfill for electrical direct burial or concrete encased duct in paved areas under roadway shoulder shall be wet sand slurry.
- C. Backfilling prior to approvals: Do not allow or cause portions of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections. Should any of the work be so enclosed or covered up before it has been inspected, uncover such work at no additional compensation.
- D. Backfill simultaneously on both sides of utility to prevent displacement.
- E. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.
- F. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 COMPACTION

- A. Place and compact fills in accordance with recommendations of the Report on Geotechnical Investigation.
- B. Utilize mechanical compaction equipment in grading operations. In no case shall water settling or "jetting" be employed. Vibratory compaction equipment employed shall be subject to the approval of the Architect to ensure that vibrations will not be created that will affect existing construction or slopes.

3.11 FINISH GRADING

- A. After construction and final clean-up of exterior, and removal of debris, grade building site to slopes and elevations directed.
- B. Leave graded areas raked smooth.
- C. Remove excess material from the site.

3.12 FIELD QUALITY CONTROL

- A. Earthwork, footings depths, and excavations for foundations shall be inspected by the Geotechnical Engineer to verify allowable soil bearing and low settlement and swell potential, and to make any additional recommendations.

- B. Tests: Inspection and testing of earthwork shall be performed by a testing laboratory in accordance with Section 01 45 00.
1. Provide free access to Work and cooperate with appointed firm.
 2. Tests of materials may be performed to ensure conformance with specified requirements.
 3. Provide one field density test of under-slab fill for every 2,000 square feet of building area.
 4. Provide two field density tests of backfill at locations and elevations directed.
 5. Provide one field density test of prepared subgrade for every 2,000 square feet of site and building area.
 6. Soil compaction which does not meet the specified requirements shall be recompact and reworked as directed by the Geotechnical Engineer through the Architect.

3.13 PROTECTION

- A. Protect newly graded areas from traffic and erosion, keep areas free of trash and debris. Repair and establish grades in any areas settled, rutted or eroded.

END OF SECTION

SECTION 31 31 00

SOIL TREATMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pretreatment to provide chemical barrier to protect buildings and contents against attack by subterranean termites.
 - 2. Treatment of site and areas as indicated to remove vegetation growth.

1.02 SUBMITTALS

- A. Product Data: Submit label indicating Manufacturer's chemical analysis of treatment materials prior to application. Submit evidence of EPA approval and State registration.
- B. Test Reports: Submit reports of field tests for termite treatment.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Registered applicator with 5 years experience and licensed by the Arizona Structural Pest Control Commission.
- B. Regulatory Requirements: Chemicals shall be approved for use and registered by Environmental Protection Agency (EPA) and the Arizona Structural Pest Control Commission.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Conform to Manufacturer's instructions and Governmental Agencies' requirements.
- B. Deliver materials to Project in original sealed and labeled containers of Manufacturer.

1.05 SITE CONDITIONS

- A. Do not apply chemicals in inclement weather or when there is a possibility of rain.

1.06 WARRANTY

- A. Upon completion of soil treatment, and as a condition of final acceptance, provide Owner with written unlimited warranty providing:
 - 1. Application was made at concentration, rate, and method in compliance with Specifications contained herein.
 - 2. Warrants effectiveness of the soil treatment against subterranean termite infestation for a period of not less than 5 years from acceptance and completion date of Project.
 - 3. Warrants effectiveness of soil treatment against vegetation growth for a period of six (6) months.

- B. Upon evidence of subterranean termite activity within warranty period, re-treat area to stop infestation of affected areas and repair termite caused damage to building at no cost to Owner.
 - 1. Re-treatment under warranty sufficient to prevent termites from attacking building or its contents during remainder of initial warranty period, plus one additional year for each time re-treatment under warranty is required.
 - 2. Complete re-treatment of the building shall be as specified herein and shall be rendered upon the third recurrence of subterranean termites in the same structure within 5-year period from the date of project acceptance.
 - 3. Damage caused by infestations and by re-treatment shall be repaired at no cost to the Owner.
- C. Upon evidence of vegetation growth re-treat area at no cost to Owner.
- D. Draft warranty in favor of Owner, successors or assigns.
 - 1. Pre-printed FHA or VA guarantee forms shall not be acceptable.
 - 2. The Owner and the applicator reserve the option to renew termite protection on an annual basis after the expiration of the warranty.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Termite Treatment: Apply one of the following chemicals as a water emulsion (no oil solutions permitted):
 - 1. Altriset (Chlorantraniliprole) Syngenta www.syngentaprofessionalproducts.com
 - 2. Demon Max (Cypermethrin) Syngenta www.syngentaprofessionalproducts.com
 - 3. Dominion 21 (Imidacloprid), Control Solutions Incorporated (CSI) www.controlsolutionsinc.com
 - 4. Dragnet SFR (Permethrin), FMC Corporation www.fmc.com
 - 5. Phantom (Chlorfeapyr) BASF - www.termidorhome.com.
 - 6. Premise (Imidacloprid), or Premise 75, or Premise Pre-Construction; Bayer Environmental Science www.bayerprocentral.com
 - 7. Prelude (Permethrin); AMVAC www.amvac-chemical.com
 - 8. Prevail FT (Cypermethrin); FMC Corporation www.fmc.com
 - 9. Talstar (Bifenthrin), FMC Corporation. www.fmc.com
 - 10. Termidor HE (Fipronil) BASF - www.termidorhome.com.
 - 11. Transport (Acetamiprid and Befenthrin); FMC Corporation www.fmc.com
- B. Vegetation Treatment:
 - 1. Pre-Emergent:
 - a. Oryzalin (Surflan).
 - 2. Post-Emergent:
 - a. Roundup; Monsanto www.roundup.com
 - b. Season Long or Ground Clear; ORTHO www.ortho.com
 - c. SeasonPlus Grass and Weed Killer Plus Preventer; Spectracide www.spectracide.com
- C. Mix solutions in accordance with Manufacturer's directions to highest concentration allowable by label.

PART 3 EXECUTION

3.01 APPLICATION - TERMITE CONTROL

- A. Time of Application:
 - 1. Notify Architect to be present during application, at least 24 hours prior to application of materials.
 - 2. Apply chemical treatment during normal working hours in order to be subject to observation.
 - 3. Do not treat soil and fill areas that are excessively wet or after heavy rains to avoid surface flow of toxicants.
- B. Application: In accordance with Manufacturer's recommendations, and local codes and regulations.
 - 1. Provide applicator trucks with approved measuring flow meters.
 - 2. Apply chemicals on soils and compacted ABC fill materials under entire subsurfaces of concrete floor slabs and slabs abutting building walls in quantities and locations stated on label.
- C. Do not disturb aggregate base course and treated soil between application of poison and pouring of concrete.
 - 1. Re-treat soil or compacted fill which has been disturbed after soil poisoning, due to plumbing and electrical changes or omissions.
 - 2. Should rainy weather occur prior to pouring concrete slab over treated ABC, re-treat the complete area at the discretion of Architect, and at no additional cost to Owner.

3.02 APPLICATION - VEGETATION CONTROL

- A. Apply chemical to on-site landscape areas and landscaped portions of public street right-of-ways of site.
- B. Chemical Control: Prior to planting operations, provide 2 applications over unwanted vegetation.
- C. Pre-emergent: Post landscape planting operations. Comply with manufacturers label for application and protection of existing landscape planting.

3.03 FIELD QUALITY CONTROL

- A. Tests: Chemical analysis tests shall be made of materials used on the basis of one test for each 10,000 square feet of treated area. Samples and test may be taken of both concentrates and the dilute materials as being applied. See Section 01 45 00 for provisions covering payment for testing.

3.04 PROTECTION

- A. Adjacent property, trees and plants shall be protected from injury and damage as result of operations in this Section.

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes asphaltic concrete paving as indicated on Drawings, including cutting and patching of existing asphaltic concrete paving at street right-of-ways where existing pavement is removed to accommodate new construction.

1.02 SUBMITTALS

- A. Design Mix: Submit design mix-formula for asphalt concrete not less than 7 days in advance of actual placement of material.
- B. Certificates: Submit Certificate of Compliance indicating that materials to be incorporated in Work meet Specification requirements.

1.03 QUALITY ASSURANCE

- A. Comply with Maricopa Association of Governments (MAG) Specifications except as specified otherwise.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Transport bituminous mixtures to site in clean trucks and in manner to prevent segregation of materials or inclusion of foreign substances.
- B. Mix to consist of specified aggregate and bitumen.
- C. Asphalt surface course mixture to have minimum temperature of 285 degrees F. and maximum temperature of 350 degrees F.

1.05 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Conform to applicable requirements of MAG Section 321.
 - 2. Place asphaltic concrete when surface is dry, when the ambient temperature in shade is 40 degrees F. and rising, or above 50 degrees F. if falling.
 - 3. Do not place asphaltic concrete when weather is foggy, rainy, or when base on which material is to be placed is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate Base Course:
 - 1. Base materials: Conform to MAG Sections 310 and 702 and requirements specified herein. Material to be crushed rock product with a plasticity index not exceeding 5 and comply with grading requirements shown in Table 702.

2. Aggregate: Clean and free of organic matter and of such a nature that it can be compacted to a dense and firm layer capable of supporting loaded trucks and self-propelled pavers without rutting.
 3. Deliver aggregate to site in thoroughly blended condition and handle in manner to prevent excessive segregation. Do not mix underlying soil or subbase with aggregate base material. Do not mix underlying soil or subbase with aggregate base material.
- B. Tack Coat: Mixing type emulsion SS-I-H, as specified in MAG Section 713, diluted in proportion of approximately 50 percent water and 50 percent emulsion. See MAG Section 321.
- C. Asphaltic Concrete Paving:
1. Refer to MAG Section 710.
 2. Asphalt concrete shall be Type 1/2 inch or 3/4-inch single course mix as indicated on Drawings. Percentage asphalt range: 5.0 to 6.0.
 3. When test procedures determine aggregate is subject to stripping, add dry hydrated lime conforming to requirements of ASTM C207, Type N; portland cement conforming to Section 725 of MAG Specifications; or other approved anti-strip agent.
- D. Composition and Grading: Comply with MAG Section 710.3. Aggregates and mix to be incorporated into Work shall show loss in L.A. Rattler (ASTM C131) (after 500 revolutions) of 40 percent max.

2.02 EQUIPMENT

- A. Spreading and Finishing Equipment: Comply with MAG Section 321.5.2.
1. Equipment to be of good condition and capable of performing Work specified in satisfactory manner.
 2. Start finish rolling after pavement has cooled sufficiently to permit removal of roller marks and continue in whatever direction is necessary to produce a pavement surface free of indentations. See MAG Section 321.
 3. Leveling Course: Comply with MAG Section 321.5.3.

2.03 MIXES

- A. Job-mix formula shall indicate percentage passing for each specified sieve size of mineral aggregate and percent of asphalt to be used for each asphalt concrete mixture to be incorporated on Project. Job-mix formula (gradation), with allowable tolerances for a single test, to be used for job control. Single test variation tolerance is shown in following table. In no event shall less than 2 percent of mineral aggregate pass a No. 200 sieve.
1. No. 4 and larger : ± 7
 2. No. 30: ± 5
 3. No. 200: ± 2
 4. Asphalt, percent by weight of mix: ± 4

PART 3 EXECUTION

3.01 PREPARATION

- A. Backfill curbs prior to paving.
- B. Base Preparation: Comply with MAG Section 321.5.1.

3.02 CUTTING AND PATCHING OF ASPHALT CONCRETE PAVING

- A. Cut existing asphalt pavement back a minimum of 4 inches into stable, sound pavement material with stable, undisturbed bases.
 - 1. Remove and recompact existing subgrades and/or base course materials necessarily disturbed, that are loose, or un-bound.
 - 2. Saw-cut existing asphalt vertically to full depth.
 - 3. Saw-cut and remove areas in square, rectangular or trapezoidal shapes. Do not leave irregular or fractured faces of any size.
- B. At patched areas, provide aggregate base course materials to match existing depth and tie into existing. Compact level to existing.

3.02 APPLICATION

- A. Base Course:
 - 1. Construct aggregate base course on subgrade and compact to a minimum of 95 percent of maximum density in accordance with ASTM D1557.
 - 2. Thickness: Place base course materials in minimum compacted thickness indicated on Drawings, or to match existing at patched areas.
- B. Tack Coat:
 - 1. Apply tack coat to vertical surfaces of existing pavement, curbs, gutters and construction joints, against which additional material is to be placed, to a new or old pavement to be overlaid, and to other surfaces as designated by Architect.
 - 2. Tack coat to be slow setting type emulsion as specified. If emulsion is applied undiluted, apply at rate of 0.02 to 0.10 gallons per square yard; if emulsion is applied diluted 1:1 with water, apply at rate of 0.05 to 0.10 gallons per square yard, as directed by Architect.
 - 3. Clean surfaces of loose and foreign material prior to application of tack coats.
- C. Asphaltic Concrete:
 - 1. Construct asphalt pavement in accordance with applicable requirements of MAG Section 321.
 - 2. Thickness: Place asphalt concrete in minimum compacted thickness indicated on Drawings, or to match existing at patched areas.
 - 3. If pavement is constructed in lifts using an asphalt concrete base in the first lifts, base to be thoroughly cleaned by whatever means necessary prior to application of tack coat and placement of surface layer.
- D. Compaction: Comply with requirements of MAG Section 321.5.4.
 - 1. Compact asphalt concrete surfacing to a density of 95 percent of 75 blows (ASTM D6926).
 - 2. Measure asphalt density by means of a nuclear density gauge, or core testing. Nuclear gauge method will be preferred.
- E. Upon completion, pavement surface to be smooth, dense and of uniform texture and appearance.
 - 1. All areas to properly drain and be free of standing water.
- F. Tolerances:
 - 1. Thickness: Compacted thickness shall be within the following tolerances from thickness indicated.
 - a. Base Course: Plus or minus 1/2 inch .
 - b. Surface Course: Plus or minus 1/4 inch .

2. Surface Smoothness:
 - a. Base Course: Plus or minus 1/2 inch, measured using a 10 foot straight-edge placed in any position on finished surface, except across flow lines.
 - b. Asphalt Concrete Surface Finish: Minus 1/4 inch from the lower edge of a 25 foot straight-edge laid on the finished surface of the asphalt and parallel with the center line of the road or drive.
 - c. Asphalt Concrete Crowned Surface Finish: Plus or minus 1/4 inch, measured with a crowned template.

G. Corrective Requirements for Deficiencies: Comply with MAG Section 321.6.

H. Paving Termination:

1. Provide thickened edge at paving terminations that do not have wood header forms or concrete curbs.
2. Pavement termination to be minimum 12 inches wide x 8 inches deep or as shown on Drawings.

3.03 FIELD QUALITY CONTROL

A. Smoothness Tests:

1. Test conformance of crown and grade of pavement as indicated. Finished surface to be smooth and finished within specified tolerances.
2. Immediately after initial rolling, correct variations by adding or removing material as required. Cut out and replace any spots deficient in thickness with fresh mixture which is properly bonded to existing pavement.
3. After final rolling, retest surface and correct irregularities in excess of specified tolerance by removing defective Work and replacing with new material.

B. Water Testing: Perform water testing of streets per MAG Section 321.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes portland cement concrete paving and accessories.
- B. Related Sections:
 - 1. Section 07 92 00 – Joint Sealers, for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
 - 2. Section 32 16 00 - Concrete Curbs, Gutters, Sidewalks, and Driveways for concrete curbs, gutters, sidewalks, and drive entrances.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.03 SUBMITTALS

- A. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Mix designs are subject to approval of the Owner's testing laboratory of record for compliance with requirements.
- B. Material certificates.
- C. Pavement Joint and Placement Plan - indicate location of all pavement joints and their type, a detailed sequence and schedule of concrete placement operations including, but not necessarily limited to; width and area of pavement to be placed, proposed equipment, production rates, working hours, concrete hauling and access location, placement methods, curing, sawing and sealing methods. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Pavement shall not be opened to traffic less than seven days after placement, and until all joints are sealed and the concrete has attained a compressive strength of at least 3,000 psi, unless otherwise approved by the Architect.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable Federal, State and local ordinances, including Arizona Highway Department Standard Specifications (ADOT) and MAG Specifications. Where geotechnical report or notes on drawings state more restrictive requirements, the requirements of the geotechnical report or notes on drawings shall govern.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

- D. Concrete Testing Service: Engage a qualified independent testing agency to design concrete mixes.

PART 2 PRODUCTS

2.01 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 of a radius 100 feet 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.

2.02 REINFORCING MATERIALS

- A. Grade 40 Reinforcing Bars, Wire Fabric and Plain Wire: Comply with Section 03 32 00.
 - 1. Wire Fabric: Flat sheets, not rolls.
- B. Joint Dowel Bars: Plain steel bars conforming to Section 03 32 00. Cut bars true to length with ends square and free of burrs.
- C. Bar Supports: Comply with Section 03 32 00.
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
- D. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.03 CONCRETE MATERIALS

- A. General:
 - 1. Concrete materials shall conform to MAG Specifications, Sections 324, 725, and 726; and ADOT Section 401 and City of Phoenix Supplements.
 - 2. Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type II, unless otherwise indicated on Drawings, low alkali, conforming to MAG Specifications.
 - 1. Supplementary Cementitious Materials (Pozzolans): In accordance with MAG Section 725.2.1 and as specified in Section 03 05 05.
 - 2. Aggregate: Crushed rock or gravel conforming to the requirements of ASTM C33. Course aggregate gradation shall conform to the requirements of Size No. 57. Fine aggregates shall have an average sand equivalent of not less than 75 when tested in accordance with the requirements of AASHTO T-176 or ASTM D2419.
- C. Water: ASTM C1602.

2.04 ADMIXTURES AND ADDITIVES

- A. General:
 - 1. Admixtures or additives of any type, except as otherwise specified, shall not be used unless identified in the approved mix design or authorized by the Civil Engineer.
 - 2. Admixtures shall be certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C260.
- C. Water-Reducing Admixture: ASTM C494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

2.05 ACCESSORIES

- A. Expansion Joint Filler: MAG Section 729.
- B. Epoxy Resin: Sta-Crete Epoxy Resin No. 15-J or 20.
- C. Curing Compound: Concrete curing materials shall in conformance with MAG Section 726.
- D. Joint Sealant: One-component, hot-poured type, conforming to the requirements of ASTM D3406. Where approved by the Civil Engineer, other pour-type joint sealants conforming to the requirements of MAG Section 729.2 may be used.

2.06 CONCRETE MIXES

- A. Mix design proportioning shall be in accordance with MAG Section 725.6.
- B. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45 maximum at point of placement.
 - 3. Slump Limit: 4 inches.
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
- C. Supplementary Cementitious Materials (Pozzolans): Limit percentage, by weight, of cementitious materials other than Portland cement according to MAG Section 725.2.1.
- D. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.07 CONCRETE MIXING

- A. Mixing shall be in accordance with MAG Section 725.7.

PART 3 EXECUTION

3.01 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 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.

3.03 CONSTRUCTION METHODS

- A. Pavement shall be constructed with mechanical equipment utilizing stationary side forms or by the use of slipform paving equipment without stationary side forms in accordance with MAG Section 324. Manual methods of placing and finishing concrete with stationary side forms may be permitted by the Engineer for areas inaccessible for mechanical equipment.

3.04 SUBGRADE PREPARATION

- A. Comply with the recommendations set forth in the Report on Geotechnical Investigation, prepared by Speedie and Associates and MAG Section 324.3.3. Subgrade shall conform to the compaction and elevation tolerances specified for the material involved, shall be kept smooth and compacted, and shall be free of all loose and extraneous material when concrete is placed.

3.05 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.06 PLACING, SPREADING AND COMPACTING

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Comply with requirements of MAG Section 324.3.5 for placing, spreading and compacting Portland cement concrete paving.
- E. Shaping and Initial Finishing: In accordance with MAG Section 324.3.6.
- F. Utility manholes and valves shall be adjusted in accordance with MAG Section 345.

3.07 FINAL FINISHING

- A. General: Wetting of concrete surfaces to assist in finishing operations is not permitted unless approved by the Civil Engineer. When allowed, it shall be applied as a fog spray with approved equipment.
- B. Final finishing shall be in accordance with MAG Section 324.3.7.
 - 1. Texture: As indicated on Drawings or as directed by Architect and/or Civil Engineer.

3.08 CURING

- A. Curing shall begin immediately following surface texturing and edging. Cure concrete paving in accordance with MAG Section 324.3.8.

3.09 JOINTS

- A. Portland cement concrete paving joints and dowels shall conform to ACI 330R-87.
- B. Joints shall be provided in the pavement of the type, dimensions and at the locations as indicated in the plans or as specified in MAG Section 324.3.9.
- C. Construct 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.
- D. 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. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- E. 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 as indicated on approved Pavement Joint and Placement Plan.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface.
 - 4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 5. 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.
- F. 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 for all epoxy-coated dowels installed in expansion joints.
- G. 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 groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 1/4 inch.
- H. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
 - 1. Radius: 1/4 inch.
- I. Sealing of Joints: In accordance with MAG Section 324.3.9.5.4.

3.10 REPAIR OF NEW CONCRETE PAVING

- A. Contractor shall be responsible for replacing or repairing all areas of pavement containing uncontrolled cracking, surface spalls, or other types of surface defects as directed by the Architect and/or Civil Engineer. Repairs shall be made by methods acceptable to the Architect and/or Civil Engineer and the repair shall be completed to the satisfaction of the Architect and/or Civil Engineer.

3.11 FIELD QUALITY CONTROL

- A. Testing:
 - 1. Field Sampling and cylinder strength testing shall be conducted in accordance with MAG Section 725.8.
 - 2. Testing of concrete smoothness and pavement thickness shall be conducted in accordance with MAG Section 324.4.

3.12 PROTECTION

- A. Provide protection of finished concrete paving in accordance with MAG Section 324.5.

3.13 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 32 16 00

CONCRETE CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete curbs, gutters, sidewalks and driveways as shown on the Drawings, including cutting and patching of existing concrete curbs, gutters, walks and driveways where removed or modified to accommodate new construction.
- B. Related Sections:
 - 1. Section 31 13 13 – Concrete Paving, for portland cement concrete paving and accessories.
 - 2. Section 32 17 26 – Detectable / Tactile Warning Surfaces, for detectable/tactile warning tile for use on on-site sidewalk ramps.

1.02 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable Federal, State and local ordinances, including MAG Specifications. Where geotechnical report, General Structural Notes, or notes on drawings state more restrictive requirements, the requirements of the geotechnical report, General Structural Notes, or notes on drawings shall govern.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete for Curbs, Gutters, Sidewalks, and Sidewalk Ramps: Class B, complying with applicable requirements of MAG Section 725.
- B. Concrete for Drives: Comply with Section 1006 of the ADOT Standard Specifications and recommendations of the Report on Geotechnical Investigation.
- C. Expansion Joint Filler: MAG Section 729.
- D. Epoxy Resin: Sta-Crete Epoxy Resin No. 15-J or 20.
- E. Curing Compound: ASTM C309, Type 1, Class B; acrylic type.
- F. Traffic Joint Sealant: As specified in Section 07 92 00.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cut existing pavements and concrete joined by new construction in accordance with MAG Sections 336 and 350. Saw-cut and remove existing concrete at stable undisturbed material to remain or extend removal to construction joint.
 - 1. Do not disturb existing base course materials at concrete to remain.

2. Remove and recompact existing subgrades and/or base course materials necessarily disturbed, that are loose, or un-bound.
 3. Saw-cut existing concrete vertically to full depth.
 4. Saw-cut and remove areas in square, rectangular or trapezoidal shapes. Do not leave irregular or fractured faces of any size.
 5. Remove existing walks and/or drives as indicated or as necessary to tie into and match finished elevations of new Work.
- B. Construct subgrade and compact true to grades and lines shown on Drawings and as specified in MAG Section 301.
- C. Do not disturb previously prepared subgrades and subbase course. Where loose soils are encountered beneath pavements, scarify, moisture condition and properly recompact soils in compliance with Section 32 00 00.
- D. Material displaced during construction shall not be placed on base or surfacing material already in place on roadway. Do not place excavated material in manner as to interfere with access to property or traffic flow in street.
- E. Remove existing walks and/or drives as indicated and as required to tie into and match finished elevations of new Work.

3.02 CONCRETE CONSTRUCTION

- A. Construct concrete curbs, gutters and sidewalks by conventional use of forms, or by means of a curb and gutter machine when approved by Architect.
1. If machines designed specifically for such work and approved by the Architect are used, results must be equal to or better than that produced by use of forms.
 2. If the results are not satisfactory to Architect, discontinue use.
 3. Requirements applicable to use of forms shall apply to use of machines.
- B. Extruded Concrete Curbs Without Gutter: Provide extruded concrete formed-in-place curbs to cross section and locations as shown on Drawings and as specified.
- C. Concrete for Curbs, Gutters and Sidewalks: 40 percent stone by weight and extruded in a zero slump condition.
- D. Jointing: Finish all joint fillers in continuous one-piece lengths.
1. Construct expansion and control joints vertical, and at right angles to centerline of drive and match joints in adjacent pavement or sidewalks.
 2. Concrete drives: Provide expansion joints at maximum 15 feet o.c., unless otherwise indicated on Drawings.
 3. Curbs, Gutters and Walks: Provide expansion joints at maximum 20 feet o.c., unless otherwise indicated on Drawings.
 4. Provide construction joints at all side and end terminations.
 5. Provide isolation joints at all areas abutting curbs, catch basins, manholes and similar civil structures, walks, buildings, and other fixed objects.
 6. Construct expansion joints at radius points, driveways, alley entrances and at adjoining structures.
 7. Construct contraction joints as detailed.
 8. Fill expansion and contraction joints with traffic joint sealant as specified in Section 07 92 00.
- E. Bonding:
1. Bond extruded concrete curbing to asphalt surfacing by use of SS-1-H or CSS-1-H cutback asphalt tack coat conforming to requirements of MAG Section 713.

2. Apply tack coat in a manner approved by Architect to provide a uniform continuous coating 1/8 to 3/16 inch in thickness and a width one inch less than the base width of curbing.
 3. Take care to prevent spills or running of tack coat over surface of finished asphalt pavement.
 4. Bond extruded concrete curbing to concrete surfaces by use of an epoxy resin.
- F. Forms:
1. Carefully set forms to line and grade, securely staked in position and conforming to dimensions of curbs, gutters, sidewalks, driveways and alley intersections.
 2. Moisten forms and subgrade immediately in advance of placing concrete.
 3. Clean forms thoroughly each time they are used, and coated with a light oil, or other releasing agent of a type which will not discolor concrete.
 4. Thoroughly spade concrete away from forms so that there will be no rock pockets next to forms.
 5. Concrete may be compacted by mechanical vibrators approved by Architect.
 6. Continue tamping or vibrating until mortar flushes to surface, and coarse aggregate is below concrete surface.
- G. Shape edges with tool formed to round edges to radius indicated on standard details.
- H. Form Removal:
1. Do not remove front face form before concrete has taken initial set and has sufficient strength to carry its own weight.
 2. Do not remove gutter forms and rear forms until concrete has hardened sufficiently to prevent damage to the edges.
 3. Take special care to prevent damage.
 4. Repair any portion of concrete damaged while stripping forms. If damage is severe, replace at no additional cost to Owner.
- I. Finishing and Curing:
1. Comply with MAG Section 505 and Specifications Section 03 30 00 for finishes and special finishes, and as indicated on Drawings.
 2. Take care in extruding radiuses and corners to prevent cracking and breaking of concrete curbing.
 3. Finish extruded curbs immediately after placing to achieve a surface comparable to a uniform broom finish.
 4. Coordinate finishing with installation of ADA paver tiles specified in Section 32 17 26.
 5. Spray extruded curbs with curing agent sealer immediately after placing.
 6. Thoroughly fill, bond, and finish breaks or cracks to match remaining installation in manner approved by Architect.
 7. Curbing found unacceptable by Architect to be replaced at Contractor's expense.
- J. Backfilling: Unless otherwise specified, backfill behind curbs or sidewalk with native soil to lines and grades shown on Drawings.

3.03 FIELD QUALITY CONTROL

- A. Testing:
1. Test face, top, back and flow line of curb and gutter with a 10-foot straightedge or curved template, longitudinally along surface.
 2. Correct deviations in excess of 1/4 inch.
 3. Test surface of concrete sidewalks with a 5-foot straight edge. Correct deviations in excess of 1/8 inch.

4. Gutters:
 - a. When required by Architect, water test gutters having a slope of 0.8 foot per 100 feet or less, and where unusual or special conditions indicate gutter may not drain satisfactorily.
 - b. Water testing consists of establishing flow in length of gutter to be tested by supplying water from a hydrant, tank truck or other source.
 - c. One hour after supply of water is shut off, inspect gutter for evidence of ponding or improper shape.
 - d. In the event water is found ponded in gutter to a depth greater than 1/2 inch, or on the adjacent pavement, correct defect or defects in a manner acceptable to Architect.
5. Remove and replace sections of Work deficient in depth or not conforming to Drawings or Specifications.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 32 17 13

WHEEL STOPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes precast concrete wheel stops and anchoring devices.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wheel Stops: Provide wheel stops conforming to one of the following:
 - 1. Comply with MAG Standard Detail 150, Type B-3, and MAG Uniform Standard Specifications Section 410.
 - 2. Precast concrete, 3-1/2 percent minimum air-entrained concrete, 4,000 psi minimum compressive strength. Each stop shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate. Half octagonal configuration, 72 inches length.
- B. Adhesive for Bonding Dowel to Wheel Stop: As proposed by Contractor and approved by the Engineer, suitable for application.
- C. Steel Bar Hold Down Pins: Galvanized 5/8 inch diameter steel dowels or galvanized No. 5 steel reinforcing bars.
- D. Anchoring Adhesive: 2-component epoxy adhesive complying with MAG standard Specifications.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install bumpers at locations indicated on Drawings.
- B. Concrete Pavement Areas: Install each unit with epoxy adhesive. Use adhesive in accordance with manufacturer's printed instructions.
- C. Asphalt Pavement Areas: Install each unit with hold-down pins driven through pavement.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Traffic marking and striping for pavement and curbs as shown on Drawings.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's specifications for paint.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Traffic Surface Paint: Approved products include, but are not limited to the following:
1. Sherwin-Williams, Pro-Park www.sherwin-williams.com Waterborne Traffic Marking Paint B97 Series, or STAR-Brite Latex Traffic Line Paint S11 Series.
 2. PPG Architectural, Ennis www.ppg.com Waterborne Traffic Paint Lead Free Yellow 445017, Waterborne Traffic Paint White 445018, or Zoneline Traffic & Zone Marking Paint 11-53.
 3. Kelly-Moore, Traffic Marking Paint www.kellymoore.com Curb Marking Paint waterborne Semi-Gloss 1473, Zone Marking Paint Lead Free Waterborne 1472.
 4. Benjamin Moore www.benjaminmoore.com, Coronado Super Kote Quick Dry Acrylic Traffic Paint 1406 Line, or Insi-x Traffic Paint Acrylic Latex TP-2200.
 5. Lanco www.lancopaints.com Super traffic waterborne, Super Traffic TL Line, or Painters Marking Coat, Painters traffic VA Line.
 6. Ennis-Flint www.ennisflint.com EF Series Standard Dry Waterborne traffic paint.
 7. Professional Pavement Products, Inc. www.pppcatalog.com Prostripe Plus Waterborne Traffic Paint.
 8. Sealmaster Pavement Products and Equipment www.sealmaster.net Sealmaster Acrylic Traffic Paint.
 9. Products listed in the MAG Uniform Standard Specifications.
- B. Traffic Surface Paint Colors: As follows, unless otherwise indicated on Drawings:
1. Stall Striping and Traffic Markings: Traffic White
 2. Handicap Markings: Traffic Yellow.
 3. Fire Lanes: Red.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prepare chalk layout and obtain Architect's approval prior to start of marking and striping.

3.02 PREPARATION

- A. Thoroughly clean surfaces of substances which may inhibit bonding.

3.03 APPLICATION

- A. Apply paint with equipment suited for that purpose in accordance with Manufacturer's directions.
 - 1. Paint lines straight and true to pattern layout. Correct errors by sandblasting. Apply paint at manufacturer's recommended rates to obtain a dry film thickness of 8 mils minimum in a minimum of two (2) coats.
 - 2. Stall Divisions: Provide between standard size parking stalls, a single 4 inch wide stripe, stall width as shown on Drawings.
 - 3. Arrows and Pavement Signs: Paint directional arrows with stencils or other approved method. Strokes of letters, islands and "No Parking" areas to have 3 inch wide strips.
 - 4. Handicap Stalls: Provide symbol and other markings as approved by Architect.
 - 5. Fire Lanes: Provide red painted curbs as required.
 - 6. Protect completed Work until dry.

END OF SECTION

SECTION 32 17 26

DETECTABLE/TACTILE WARNING SURFACES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Modular tactile/detectable warning surface paver tiles and setting materials.
- B. Related Sections:
 - 1. Section 32 16 00 – Concrete Curbs, Gutters Sidewalks and Driveways, for concrete walk ramps where detectable warning tiles will be installed.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit three (3) tile samples minimum 6 inches by 8 inches of the kind proposed for use.

1.03 QUALITY ASSURANCE

- A. Provide Modular Paver Tactile Tile and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide Detectable/Tactile Warning Surface Panels which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).

1.04 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings. And tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

1.05 SITE CONDITIONS

- A. Environmental Conditions and Protection: Temperature shall be minimum of 40 degrees F at location to receive tactile tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation.
- B. Water used for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the public. Provide barricades or screens as required to protect public.

- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.06 EXTRA STOCK

- A. Deliver extra stock to storage area designated by Architect. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for modular paver tiles. Furnish not less than 2 percent of the supplied materials for each type, color and pattern installed, but not less than 2 tiles.

1.07 GUARANTEE

- A. Modular Paver Tactile Tile shall be guaranteed in writing for a period of five years from date of final completion. The guarantee includes defective work, breakage, deformation, and loosening of tiles.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with ADA and other specified requirements, provide one of the following, subject to approval by Architect:
 - 1. Armor-Tile Vitrified Polymer Composite (VPC) Modular Paver Tactile Tile as manufactured by Engineered Plastics Inc. (800-682-2525) www.armor-tile.com .
 - 2. Tekway Detectable Warning concrete panels as manufactured by StrongGo LLC, Tucson, Arizona www.stronggo.com
 - 3. As approved by the Architect.
- B. Tactile/Detectable Warning Surface Tiles:
 - 1. Precast Concrete Lightweight Panels: High compressive strength lightweight precast concrete containing salt river aggregate and proprietary additives.
 - a. Size: 24 inches x 24 inches x 5/8 inch thickness.
 - 2. Vitrified Polymer Composite (VPC) Modular Paver Tactile Tile: Epoxy polymer composition with ultraviolet stabilized coating employing aluminum oxide particles in the truncated domes.
 - a. Size: 12 inches x 12 inches x 1.4 inch thickness.
- C. Where available from the manufacturer, provide pavers with integral anchors cast into pavers for wet installation into concrete walk.
- D. Color(s): "Red" as selected by Architect from manufacturer's full line of colors.
- E. Installation Materials: Provide paver manufacturers recommended thin-set acrylic modified Portland cement thin set mortar and joint grout.
- F. Sealants: Traffic bearing sealant as recommended by paver manufacturer and complying with section 07 92 00.
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install tiles/pavers in accordance with manufacturer's setting and finishing instructions.
- B. During tile installation procedures ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- C. Install sealant and related materials shall be in accordance with paver manufacturer's recommendations and the guidelines of sealant manufacturers.
- D. Layout Modular Pavers/Tiles and joints to fit existing spacing as detailed on the project drawings, or as approved on shop/layout drawings.
- E. Use electronic level or other acceptable devices to verify that the required slope is achieved. Tiles shall be placed true and square to the curb edge in accordance with the contract drawings.
- F. Set tiles into wet concrete or by thin-setting onto cured concrete as recommended by the tile manufacturer, as follows:
 - 1. Setting into Wet Concrete: The Modular Paver/Tiles shall be tamped into substrate to ensure that the field level of tile is flush to the adjacent surfaces and set to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
 - 2. Thin-Set Tile: Set tile into position using manufacturer's recommended mortar and grout materials.
- G. Elevation differences between tiles and between tile and adjacent surfaces shall not exceed 1/16 inch.
- H. Vacuum clean, mechanically abrade and solvent wipe the joints between Modular Paver Tactile Tiles.
- I. Place 3/8 inch diameter foam rope at bottom of all sealant joints.
 - 1. Tape off each side of leading edge groove in preparation for the self leveling urethane sealant.
 - 2. Apply urethane sealant in joints filling flush to top of tiles, then remove tape prior to curing.

3.02 CLEANING AND PROTECTING

- A. Protect Modular Tactile Pavers against damage during construction period to comply with tactile tile manufacturer's specification.
- B. Clean Modular Tactile Pavers prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean Pavers by method specified by the manufacturer.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes decorative welded tube steel fencing and gates including swing gates, hinges, locks, and miscellaneous hardware, as shown on Drawings and as specified herein.
- B. Related Sections:
 - 1. Division 03 Concrete Sections for fence and gate footings.
 - 2. Division 04 Masonry Sections for concrete unit masonry walls/piers supporting fences and gates.
 - 3. Section 05 50 00 – Metal Fabrications, for steel enclosure gates, frames and hardware and steel framed rolling entrance gates and associated supports.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Provide certification that manufacturer has been in business for a minimum of 5 years fabricating and finishing decorative metal fencing comparable to that specified in this Section and as detailed on Drawings.
 - 2. Subcontractor Qualifications: Fabricate and install the work of this Section using a subcontractor having a minimum of 3 years experience and trained in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance and desired aesthetic affect of the work of this Section.
- B. Welder Qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
- C. Reference standards: Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following.
 - 1. NAAMM Metal Finishes Manual
 - 2. AWS Structural Welding Code

1.03 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings showing layouts, dimensions, construction details and installation, including fastening devices and connection to adjoining construction and relationship with other work.
- B. Submit manufacturer's color charts or color sample units showing full range of available powder coated finish colors and finishes for initial selection purposes.
- C. Submit samples for verification purposes of powder coated finish in color selected by Architect.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Coordinate delivery of fencing from Fencing Manufacturer.

- B. Storage: Store off ground and under cover, protected from damage in accordance with fencing manufacturer’s instructions.
- C. Handling: Handle materials so that surfaces are protected. Prevent distortion or damage to fabricated pieces.

1.05 WARRANTY

- A. Provide manufacturers standard 20-year warranty covering defects in material finish, including cracking, peeling, chipping, blistering or corroding, covering all structural fence components (i.e. rails, pickets, and posts), for a period of 20 years. Warranty covers reimbursement of labor necessary to restore or replace components found to be defective for a period of 5 years.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653, with a minimum yield strength of 45,000 psi and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ sq. ft., Coating Designation G-60.
- B. Material for pickets shall be 3/4-inch square x 18 Ga. tubing. The rails shall be steel channel, 1-1/2 inches x 1.4375 inches x 14 Ga. Picket holes in the rail shall be spaced 3-1/2 inches on center for 3-inch air space. Fence posts and gate posts shall meet the following minimum size requirements:

Minimum Posts Sizes		
Fence Posts	Panel Height	
2-1/2" x 16 Ga.	Up to & Including 6' Height	
Gate Leaf	Gate Height	
	Up to & Including 4'	Over 4' Up to & Including 6'
Up to 4'	2-1/2" x 14 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12 Ga.	3" x 12 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 12 Ga.

- C. Rail Attachment Brackets:
 - 1. 90-degree design for straight (plumb and level) fence applications.
 - 2. Adjustable Bracket: Provide ball and socket design capable of 30-degree swivel (up/down – left/right) for angled installations as necessary.
- D. Picket Tops/Caps/Adornments: Provide types and design as indicated on Drawings, matching fence posts and pickets in finish and color. If not indicated, provide manufacturer’s standard cap designed for insertion into top of open pickets and posts.
- E. Anchor and Expansion Bolts: ASTM A307 anchor bolts with hot-dipped galvanized finish, unless otherwise noted. Expansion bolts to have I.C.B.O. rating for material into which the installation takes place. Furnish anchor and expansion bolts with steel washers.
- F. Concrete Footings: Normal weight 3,000 psi 28-day compressive strength, 3 inch slump, 1 inch maximum aggregate size concrete complying with Division 03 Concrete Sections, unless otherwise noted on Drawings.
- G. Touch-Up Primer and Finish: Provide manufacturers spray cans or paint pens to touch-up prime and finish exposed surfaces.

2.02 COMPONENTS AND HARDWARE

- A. Pickets, Rails, and Posts: Sizes and designs indicated on Drawings.
- B. Gates: Rails, pickets, and accessories to match fence.
 - 1. Bracing: Welded frame for bracing for structural support of minimum 300 pounds.
 - 2. Hardware: Galvanized steel or malleable steel to suit gate application.
 - a. Lockset: Self-latching, key-operated, exterior grade latch/lockset complying with requirements of Section 08 71 00.
 - b. Swing Gate Hinges: Tru Close www.truclose.net Heavy Duty Spring Hinge for Metal Gates, No. TCHD1AL2-MK2, or as otherwise selected by Architect from manufacturer's standard hinges based on application, weight, height, and expected number of gate cycles.

2.03 FABRICATION

- A. Fabricate fencing and gates to configurations shown on Drawings.
- B. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- C. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by fusion welding process, thus completing the rigid panel assembly.
- D. Manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by duplex application of epoxy primer and acrylic topcoat. Minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils.
 - 1. Color: As selected by Architect from manufacturer's standard available colors.
 - 2. Coated panels and posts shall be capable of meeting or exceeding coating performance criteria of ASTM F2408.
- E. Manufactured fence system shall be capable of meeting vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.
- F. Post Bases at CMU Walls: Where indicated on CMU stem walls, fabricate posts with welded steel base plates for attachment to concrete unit masonry walls, or with extended post length for embedment into CMU wall construction.
- G. Post Base for Footings: Fabricate posts of length indicated with concrete stud anchors for embedment into concrete footings as detailed.
- H. Gates: Fabricate to sizes and shapes indicated using steel tubing, pickets, and other miscellaneous steel items as necessary for rigidity.
 - 1. Weld frame units with continuously gas arc welded joints to form rigid one-piece units.
 - 2. Attach pickets to gate frames by welding.
 - 3. Miter corners and use concealed field splices wherever possible.
 - 4. Provide smooth exposed edges.

5. Prepare swing gates as shown or required for hardware specified and as indicated on Drawings. Provide necessary supports and reinforcements required to support hardware.
 6. Quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. Provide a minimum of 3 hinges per gate leaf.
- I. Insulate contact joints between dissimilar materials to prevent electrolytic or corrosive action.

2.04 FINISHES

- A. Powder Coat Finish: Provide multi-step oven cured TGIC powder coated finish consisting of thorough cleaning, pretreatment, powder coat primer and Ultra polyester finish (TGIC) at 2-4 mils.
1. Color: As selected by Architect from Fence Manufacturer's full range of colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
1. Verify areas to receive fencing are completed to final grades and elevations.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

- A. Posts:
1. Space posts uniformly as shown on Drawings.
 2. Anchor post bases to supporting concrete masonry wall construction with anchor bolts set into CMU wall construction as detailed. Check each post for vertical and top alignment and maintain in position during placement of anchor bolts.
 3. Where embedded in concrete, check each post for vertical and top alignment, and maintain in position during placement and concrete curing.
 4. Align fence panels between posts. Firmly attach rail brackets to posts.
- B. Posts shall be set in concrete footers having a minimum depth of 36 inches. Provide footing sizes of the following minimum diameter, but not less than diameters and depth of embedment recommended by the fence manufacturer.
1. Refer to Section 31 00 00 – Earthwork and Division 03 Concrete Sections for forming, reinforcement and cast-in-place concrete for footings.
 2. Footing Diameters – Minimum:
 - a. End and Corner Posts: 12 inches diameter.
 - b. Line Posts: 10 inches diameter.
 - c. Gate Posts: Size and depth as required by size and weight of gate, 12 inches diameter.
 3. Footing Tops: Shall be troweled smooth and beveled or crowned to drain moisture away from posts. Lower edge of bevel shall meet established finish grade.
- C. Install posts and vertical members plumb within 1/8 inch of vertical. Install longitudinal members parallel with each other and level to within 1/8 inch per 10 running feet.

- D. Comply with the following steps when cutting/drilling rails or posts:
 - 1. Remove all metal shavings from cut area.
 - 2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole and allow to dry.
 - 3. Apply 2 coats of custom finish paint matching fence color
 - 4. Failure to seal exposed surfaces per steps 1-3 above will negate warranty.
- E. Gate Installation:
 - 1. Gate posts shall be spaced according to the manufacturers' gate drawings, width of gate indicated on Drawings, and type of hardware selected.
 - 2. Securely anchor gates and erect plumb, level, and true, with smooth operating hardware installed in accordance with manufacturer's recommendations.
 - 3. Secure for full opening without interference.
 - 4. Attach hardware by means which will prevent unauthorized removal.

3.03 ADJUSTMENT

- A. Lubricate hinges and adjust gates to swing and operate freely and latch and lock securely. Adjust hardware for smooth operation.
- B. Touch up pre-finished surfaces damaged by installation to perfectly match powder coated finish using compatible touch-up paint recommended by Manufacturer.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 32 31 40

GATE OPERATOR

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Prewired, self-contained gate operators for steel framed horizontal sliding/rolling entrance gates specified in Section 05 50 00.
 - 2. Attachments and accessory equipment.
- B. Related Documents: The following Documents contain requirements that may relate to this Section:
 - 1. Section 05 50 00 – Metal Fabrications, for steel framed horizontal sliding gates.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Division 26 - Electrical: Electrical service and connection.

1.02 SUBMITTALS

- A. Submit manufacturer's catalog data with applicable information and notations, installation instructions and operation and maintenance manuals.
- B. Shop drawings shall include:
 - 1. Connections to all conditions of adjacent construction and gate types.
 - 2. Complete gate information indicating type and size of operator unit, range of travel, and electrical requirements.
 - 3. All electrical wiring diagrams for power and control.
 - 4. Size, location of concrete mounting pads.
- C. Test Reports:
 - 1. Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without breakdown.
 - 2. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Company specializing in the manufacture of security gate operators of the types specified with a minimum of five years experience. Manufacturer shall have a factory trained and authorized dealer in the metropolitan area of this project.
- B. Installer Qualifications: Company approved by the operator manufacturer and with a minimum of 3 years experience installing equipment similar to the equipment specified.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.

1.05 WARRANTY

- A. Provide five-year limited warranty against all defects in materials or workmanship; except batteries, which are covered under a one-year warranty. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Gate Operator: HySecurity gate operators model SlideDriver 40 (222 E ST) with Smart Touch Controller, or as otherwise required for size, weight and control requirements of gate.
- B. Gate operators shall be sized by the manufacturer to perform in conformance with scheduled and specified requirements for gate size, weight, function, design, and electrical and control requirements.

2.02 HORIZONTAL SLIDING GATE OPERATOR

- A. Operation: Operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 (136 kg) pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4000 pounds (1,814 kg). Gate panel velocity shall not be less than 1.0 feet (.30 m) per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The “soft stop” feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction).
- B. Standard mechanical components shall include as a minimum:
 - 1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1-1/2 inch bronze bearing surface, acting on arm pivot pins.
 - 2. Arm pivot pins: 3/4 inch diameter, stainless steel, with integral tabs for ease of removal.
 - 3. Tension spring: 2-1/2 inch heavy duty, 800 pound capacity.
 - 4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
 - 5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
 - 6. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.
 - 7. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
 - 8. Chassis: 1/4 inch steel base plate, and 12 Gauge sides and back welded and ground smooth.
 - 9. Cover: 16 Ga. zinc plated steel with textured TGIC polyester powder coat finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.
 - 10. Finish: Zinc plated steel with textured TGIC polyester powder coat finish, proven to withstand 1000-hour salt spray test.

11. Drive wheels: Two 6 inch diameter high-strength composite hub with polyurethane over mold.
 12. Drive rail: Shall be extruded 6061 T6, not less than 1/8 inch thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
 13. Hydraulic hose: Shall be 1/4 inch synthetic, rated to 2750 PSI.
 14. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
 15. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.
 16. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range minus 40 deg. F to 167 deg. F.
 17. A zero to 2000 PSI pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
 18. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.
- C. Minimum standard electrical components:
1. Pump motor: Shall be minimum 2 HP, 56C, 24 V DC motor.
 2. All components shall have overload protection.
 3. Controls: Smart Touch Controller Board with 256K of program memory containing:
 - a. inherent entrapment sensor;
 - b. built in "warn before operate" system;
 - c. built in timer to close;
 - d. liquid crystal display for reporting of functions;
 - e. 26 programmable output relay options;
 - f. anti-tailgate mode;
 - g. built-in power surge/lightning strike protection;
 - h. menu configuration, event logging and system diagnostics easily accessible with a PC and HySecurity's free START software;
 - i. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems or network interface.
 4. Control circuit: 24VDC.
- D. Required external sensors: Photo eyes to be installed such that the gate is capable of reversing in either direction upon sensing an obstruction.
- E. Control devices: Card reader, vehicle loop detectors, and connections to Owners Opta-Com control system.
- F. Options:
1. Lock for operator cover.
 2. Drive wheel manual release indicator switch.
 3. Through Beam or Reflective type photo eyes, open and close direction.
 4. HY-5A plug in loop detectors.
 5. Key operated cable manual release (secure side of gate).
 6. HySecurity factory drive rail.

PART 3 EXECUTION

3.01 SITE EXAMINATION

- A. Locate concrete mounting pad in conformance with approved shop drawings.

- B. Determine that gate operates smoothly under manual conditions prior to installation of gate operator.
- C. Verify electrical service for operator is properly installed and is at least 20 AMPS (operator wattage is 1000).

3.02 INSTALLATION

- A. Install gate operator in accordance with the manufacture's printed Instructions, current at the time of installation.
- B. Coordinate locations of operators with approved shop drawings, electrical and control connections.

3.03 FIELD QUALITY CONTROL

- A. Test gate operator though ten full cycles and adjust for operation without binding, scraping, or uneven motion.
- B. Test limit switches for proper gate position.
- C. Anchors bolts shall be fully concealed in finished installation.

3.04 SERVICE AND DOCUMENTATION

- A. Train Owner's personnel in the general maintenance of the gate operators and accessories.
- B. Provide Operation and Maintenance manuals as specified elsewhere, including VHS videotape showing all the components of the gate operator. Identify all pads and systems. Show in detail how parts are installed and serviced in the field.

END OF SECTION

SECTION 32 80 00

IRRIGATION

PART 1 GENERAL

Work for this Section includes provision of an underground drip irrigation system including the following:

- A. Trenching, stockpiling excavation materials and refilling trenches.
- B. Complete system including but not limited to back flow preventer, piping, valves, fittings, emitters, controllers and wiring and final adjustments to insure complete coverage.
- C. Water connections.
- D. Replacement of unsatisfactory materials.
- E. Clean up, inspection and approval.
- F. Tests.

1.01 REFERENCES

Perform Work in accordance with requirements of Conditions of the Contract and Division 1 - General Requirements as well as provisions of all applicable laws, codes, ordinances, rules and regulations.

Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.

- A. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.
- B. Underwriters Laboratories (UL) - UL Wires and Cables.

1.02 RELATED SECTIONS

- A. Section 31 20 00 EARTH MOVING contains requirements that may affect the work of this Section.
- B. Section 31 10 00, SITE CLEARING may contain requirements for irrigation.
- C. Section 32 90 00, PLANTING may contain requirements for irrigation.

1.03 SUBMITTALS

- A. Prepare and make submittals in accordance with conditions of the Contract.
 - 1. Operation Instructions - Submit 3 written operating instructions, including start-up with cut sheets of products, and coordinate controller/watering operation with City of Buckeye's maintenance personnel.
 - 2. Do not prepare charts until record (as-built) drawings have been reviewed by City of Buckeye's Representative.

3. Provide one controller chart for each automatic controller installed.
 - a. Chart may be reproduction of record drawing, if scale permits attach chart to the inside of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - b. Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
 - c. Identify area of coverage of each remote control valve, using a distinctly different pastel color, drawing over entire area of coverage.
 - d. Following review of charts by City of Buckeye's Representative, they shall be hermetically sealed between two layers of 20 mm thick plastic sheet.
 - e. Charts shall be completed and reviewed prior to final review of irrigation system.

4. Record Drawings (as-builts): At onset of irrigation installation secure reproducible copies of original irrigation design from City of Buckeye's Representative. Make blueline or blackline prints as required. As-built blueprints shall be brought up to date at close of working day on every Friday by a qualified draftsman. A print of record plan(s) shall be available at project site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-builts. Upon completion of project, submit for review, prior to final acceptance, final set of as-built blueprints. Dimension, from two permanent points of reference (building corners, sidewalks, road intersections or permanent structures), location of following items:
 - a. Point of connection, backflow prevention assembly
 - b. Routing of irrigation pressure lines (dimension maximum 100 feet along routing)
 - c. Remote control valves
 - d. Drip line blow out stubs
 - e. All gate valves
 - f. Controllers
 - g. Control wire routing if not in mainline trench
 - h. Other related equipment as directed

City of Buckeye's Representative will not certify any pay request submitted by the contractor if the record drawings are not current, and processing of pay request will not occur until record drawings are updated and current.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specified type(s) in a neat, orderly and responsible manner in accordance with recognized standards of workmanship with five (5) consecutive years of documented service.

- B. Special Requirements
 1. Licensed and bonded plumber(s) shall execute work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related Work. Secure a permit at least 48 hours prior to start of installation.
 2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, recompaction and repair of finish grade treatment.
 3. Coordination With Other Contracts - Protect, maintain and coordinate Work with Work under other Sections.
 4. Damage to Other Improvements - Contractor shall replace or repair damage to grading,

soil preparation, seeding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to City of Buckeye.

- C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials and systems used to perform Work. Conference shall be scheduled not less than ten (10) days prior to commencement of Work. All parties required to be in attendance shall be notified no later than seven (7) days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to City of Buckeye's Representative and installer. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

As part of the pre-construction conference, the contractor shall meet with the City of Buckeye's Representative to identify the process and schedule for completing the work. A field review of the areas of work and equipment will be conducted as part of the conference. The contractor shall identify in the field review his proposed approach to completing the work and indicate evidence of coordination with other work on the project. The contractor will accept comments from the others on the proposed activities. Within three days of the meeting, the contractor shall provide a written schedule of the proposed work for the City of Buckeye's Representative to review. Once a strategy and schedule are agreed upon, amend the schedule only as approved by the City of Buckeye's Representative.

1.05 DELIVERY, STORAGE AND HANDLING

Deliver, unload, store and handle materials, packaging, bundling, and products in dry, weatherproof, waterproof condition in manner to prevent damage, breakage, deterioration, intrusion, ignition and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer name, volume, quantity, contents, instructions and conformance to local, state and federal law. Remove and replace cracked, broken or contaminated items or elements prematurely exposed to moisture, inclement weather, temperature extremes, fire and/or jobsite damage.

- A. Handling of PVC Pipe - Exercise care in handling, loading and storing of PVC pipe. All PVC pipe shall be transported in a vehicle that allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and, if installed, shall be replaced with new piping.

1.06 JOB SITE CONDITIONS

- A. Protection of Property:

Preserve and protect all monuments, structures and paved areas from damage due to Work of this Section and as noted in Section 31 10 00 SITE CLEARING. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of City of Buckeye's Representative. All costs of such repair shall be charged to and paid by Contractor.

Protect buildings, walks, walls and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete or other building material surfaces shall be repaired or replaced at no cost to City of Buckeye. Restore disturbed areas to original condition.

- B. Protection and Repair of Underground Lines

Request proper utility company to stake exact location (including depth) of all underground electric, gas or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage, and, in the event damage does occur, contractor shall repair all damages. Contractor shall pay all costs of such repairs unless other arrangements have been made.

Contractor is to request City of Buckeye, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, City of Buckeye shall repair them at no cost to Installer. If Contractor damages staked or located utilities, Contractor shall repair them unless other arrangements have been made.

C. Replacement of Paving and Curbs

Where trenches and lines cross-existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.07 WARRANTY

- A. Manufacturer shall warranty materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guarantee workmanship through the one (1) year Plant Establishment and Maintenance Period.
- B. Settling of backfilled trenches that may occur during warranty period shall be repaired at no expense to City of Buckeye, including complete restoration of damaged property.
- C. Expenses due to vandalism before substantial completion shall be borne by Contractor.
- D. City of Buckeye will not maintain planting areas until after the one (1) year Plant Establishment and Maintenance Period.

1.08 MAINTENANCE

- A. Furnish the following maintenance items to City of Buckeye's Representative prior to Final Acceptance:
 - 1. Two sets of special tools required for removing, disassembling and adjusting each type of valve supplied on this Project.
 - 2. Two keys for each automatic controller.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General Piping: Used pipe shall not be reused on the project. All components and practices must meet the requirements and standards stipulated by Maricopa County and these Special.
 - 1. Pressure Supply Line (from point of connection through backflow prevention unit) - Type 'K' hard Copper.
 - 2. Pressure Supply Lines (downstream of backflow prevention units) – per plans.
 - 3. Non-pressure Lines - Per plans.
 - 4. Emitter Tubing - As recommended by emitter manufacturer.
- B. Copper Pipe and Fittings:
 - 1. Copper Pipe - Type K, hard tempered
 - 2. Fittings - Wrought copper, solder joint type

3. Joints - Soldered with solder, 45% silver, 15% copper, 15% zinc and 24% cadmium and solids at 1125°F and liquids at 1145°F

C. Brass Pipe and Fittings:

1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe
2. Fittings - Medium brass, screwed 125-pound class

D. Plastic Pipe and Fittings:

Identification Markings:

1. Identify all pipes with following indelible markings:
 - a. Manufacturer's name
 - b. Nominal pipe size
 - c. Schedule of class
 - d. Pressure rating psi
 - e. NSF (National Sanitation Foundation) seal of approval
 - f. Date of extrusion
2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM DI784; cell classification 12454-B, Type 1, Grade 1.
 - a. Fittings - Standard weight, Schedule 40, injection molded PVC; complying with ASTM DI784 and D2466, cell classification 12454-B.
 - i. Threads - Injection molded type (where required)
 - ii. Tees and ells - Side gated
 - b. Threaded Nipples - ASTM D2464, Schedule 40 with molded threads.
 - c. Joint Cement and Primer - type as recommended by manufacturer of pipe and fittings.

E. Low Pressure/Volume Systems:

- F. Drip Tubing - Manufactured of flexible polyvinyl chloride compound conforming to ASTM D1248, Type 1, Class C, Category 4, P14 and ASTM D3350 for PE 122111C.

- G. Fittings - Type and make recommended by tubing manufacturer.

H. Drip Valve Assembly - type and size shown on Drawings.

1. Wye Strainer – Per Plans.
2. Control Valve - 2 way, solenoid pilot operated type made of synthetic, non-corrosive material; diaphragm activated and slow closing. Include freely pivoted seat seal, retained (mounted) without attachment to diaphragm.
3. Pressure Reducing Valve – Per Plans.
4. Emitter - Per plans.

- I. Gate Valves - Brass construction; solid wedge, IPS threads, and non-rising stem with brass cross handle.

J. Valve Boxes:

1. Gate Valves, Drip Line Blow-out Stubs, and Wire Stub Box – Carson #910-12.
2. 3/4 Inch through 2 Inch Control Valves - Per plans.
3. Drip Valve Assemblies - Per plans.
4. Control Wiring Splices - Carson #910-12, or as shown on the plans.

K. Electrical Control Wiring:

1. Low Voltage:
 - a. Electrical Control Wire – shall be single conductors, type UF. solid copper conductor and PVC insulation. The wires shall be listed for direct burial in irrigation systems.
 - b. Control wire connections and splices shall be made with 3M direct bury splice, Rainbird Pentite connectors, or similar dry splice method.
2. High voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment services.

L. Automatic Controller - Size and type shown on Drawings; installed per manufacturer.

M. Backflow Preventer – Size and type as shown on plans; installed per manufacturer.

PART 3 EXECUTION

3.01 INSPECTION

A. Staking shall occur as follows:

1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact City of Buckeye's Representative 48 hours in advance and request review of staking. City of Buckeye's Representative will advise installer as to the amount of staking to be prepared. City of Buckeye's Representative will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.
2. If Project has significant topography, free-form planting beds, or other amenities that could require alteration of irrigation equipment layout as deemed necessary by City of Buckeye's Representative, do not install irrigation equipment in these areas until City of Buckeye's Representative has reviewed equipment staking.
3. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with ASTM D1557.
4. Trenching - Trench excavation shall follow, as much as possible, layout shown on drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
 - a. Clearances:
 - i. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.

- ii. Line Clearance - Provide not less than 6 inches of clearance between each line, and not less than 12 inches of clearance between lines of other trades.
- b. Pipe and Wire Depth
 - i. Pressure Supply Piping - 18 inches from top of pipe.
 - ii. Control Wiring - Side of pressure main

3.02 INSTALLATION

- A. Locate other equipment as near as possible to locations designated. City of Buckeye's Representative shall review any deviations to plans prior to installation.
- B. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40°F. When pipe laying is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform work in accordance with good practices prevailing in piping trades.
- C. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
- D. Drip Tubing:
 - 1. Install all drip tubing per the plans before installation of mulch.
 - 2. Install drip line end caps at all dead ends of emitter laterals.
- E. Control Wiring
 - 1. Low Voltage Wiring:
 - a. Bury wire between controller and electric valves in pressure supply line trenches, installed as close as possible to mainline wires to be consistently located below and to one side of pipe, or in separate trenches.
 - b. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4-inch pipe and withdrawing pipe.
 - c. Make all splices and E.V.C. connections using 3M direct bury splice, Rainbird Pentite connectors or similar dry splice method.
 - d. Install all control wire splices not occurring at control valve in a separate splice valve box.
- F. High Voltage Wiring for Automatic Controller:
 - 1. Provide 120-volt power connection to automatic controller.
 - 2. All electric work shall conform to local codes, ordinances and authorities having jurisdiction. A licensed electrician shall perform all high voltage electrical work.
- G. Automatic Controller
 - 1. Install controller in accordance with manufacturer's instruction as detailed and where shown on Drawings.
 - 2. Connect remote control valves to controller in numerical sequence as shown on Drawings.
 - 3. City of Buckeye's Representative shall approve final location of controller.

4. A separate ground wire shall be installed for each controller if multiple controllers are utilized.
 5. All above ground conduits shall be rigid galvanized with appropriate fittings.
- H. Electric Control Valves - Install 3 inches below finished grade where shown on Drawings and as detailed. When grouped together, allow at least 12 inches between valve boxes. Install each remote control valve in a separate valve box. Install individual valve box flush with ground. Place gravel in bottom of each box below valve with a minimum of 2 cubic feet of 3/4 inch crushed gravel.
- I. Drip Valve Assemblies - Install drip valve assembly as detailed.
- J. Drip Emitters - Install all surface emitters as detailed and stake with acceptable tubing stakes.
- K. Valve Boxes:
1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
 2. Brand controller letter and station number of lid on each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1-1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.
- L. Gate Valves - Install where shown on Drawings as detailed.
- M. Backflow Preventer - Install as detailed at location where shown on the Drawings or adjusted by City of Buckeye's Representative. Final location of backflow preventer to be approved by City of Buckeye's Representative.
- N. Backfilling - Do not begin backfilling operations until required system tests have been completed. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by City of Buckeye's Representative.
1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, and stone larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction and final grade requirements.
 2. Open excavations shall be protected in accordance with OSHA regulations.
 3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
 - a. Mechanical tamping.
 - b. Puddling or ponding. Puddling or ponding and/or jetting are prohibited within 20'-0" of building or foundation walls.
- O. Piping Under Paving:
1. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.

2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6 inches below pipe and 3 inches above pipe).
3. Compact backfill material in 6 inch lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Set in place, cap and pressure test all piping under paving, in presence of City of Buckeye's Representative prior to backfilling and paving operations.

P. Water Supply and Point of Connection - Water supply shall be as shown on the drawings

3.03 FIELD QUALITY CONTROL

- A. Flushing - After piping, risers and valves are in place and connected, but prior to installation of sprinkler heads, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers after flushing.
- B. Testing - Notify Construction Manager in advance of all testing. Conduct tests in presence of City of Buckeye's Representative for Project Site. Arrange for presence of City of Buckeye's Representative 48 hours in advance of testing. Supply force pump and all other test equipment.
 1. After backfilling and installation of all control valves, fill pressure supply line with water and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
 2. Leakage, Pressure Loss - Test is acceptable if no leakage or loss of pressure is evident during test period.
 3. Leaks - Detect and repair leaks.
 4. Retest system until test pressure can be maintained for duration of tests.
 5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.
- C. Pre-Maintenance Inspection
 1. Arrange for City of Buckeye's Representative's presence 48 hours in advance of walk-through.
 2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
 3. Operate each zone in its entirety for City of Buckeye's Representative at time of walk-through and, additionally, open all valve boxes if directed.
 4. Generate a list of items to be corrected prior to Final Completion.
 5. Furnish all materials and perform all Work required to correct all inadequacies of coverage due to deviations from Contract Documents.
 6. During walk-through, expose all drip emitters under operations for observation by City of Buckeye's Representative to demonstrate that they are performing and installed as designed; prior to placing of all mulch material. Schedule separate walk-through if necessary.

D. Final Maintenance Inspection:

1. Arrange for City of Buckeye's Representative's presence 48 hours in advance of walk-through.
2. Show evidence to City of Buckeye's Representative that City of Buckeye has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for City of Buckeye's Representative at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by City of Buckeye's Representative shall be reworked to complete satisfaction of City of Buckeye's Representative.
5. If after request to City of Buckeye's Representative for walk-through for Final Completion of irrigation system, City of Buckeye's Representative finds items during walk-through that have not been properly adjusted, reworked or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by City of Buckeye's Representative to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.04 ADJUSTING

- A. Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage.
- B. If it is determined that irrigation adjustments will provide proper and more adequate coverage, make such adjustments prior to Final Acceptance, as directed, at no additional cost to City of Buckeye. Adjustments may also include changes in control valve throttling.
- C. Areas that do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the City of Buckeye.

3.05 CLEANING

Maintain continuous cleaning operation throughout duration of Work. Dispose of, off-site at no additional cost to City of Buckeye, all trash or debris generated by installation of irrigation system.

END OF SECTION

32 80 00 IRRIGATION SYSTEM

SECTION 32 90 00

PLANTING

PART 1 GENERAL

The extent of landscape development work is shown on the drawings and in schedules. This Section includes provisions for the following items.

Supplying and installing trees, shrubs, accents

Soil Amendments

Inert Materials – decomposed granite, angular rock, and boulders

Landscape Maintenance

Warranty of Landscape

1.01 REFERENCES

- A. ANSI Z60.1 – American Standard for Nursery Stock; 1996
- B. ANSI A300 – American National Standard for Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices; 2001
- C. AAN-ASNS: American Association of Nurserymen, Inc. "American Standard for Nursery Stock" - 1986 Edition.
- D. AJCHN-SPN: American Joint Committee on Horticultural Nomenclature "Standardized Plant Names", Second Edition, 1942.
- E. ANA: Arizona Nursery Association Growers Committee "Recommended Tree Specifications", latest edition.
- F. ASTM: American Society for Testing and Materials.
- G. MAG Specifications latest edition.

1.02 RELATED WORK

- A. SECTION 31 20 00 EARTH MOVING contains requirements for work that may affect this work.
- B. SECTION 32 80 00 IRRIGATION contains requirements that may affect the work of this section.

1.03 SUBMITTALS

All items listed below shall be forwarded in a single package to the City of Buckeye's Representative within 45 days before planting work begins.

- A. Certification: Submit certificates of inspection as required by governmental authorities or as requested herein. Submit manufacturers or vendors certified analysis for materials in Part 2. Submit data substantiating that materials comply with specified requirements. File copies of certificates with City of Buckeye's Representative after acceptance of material.

- B. Schedule: Submit Landscape schedule; indicate beginning and end dates for each work effort (examples, fine grade, planting, pre-emergent placement, placement of inert materials, etc.). If landscape construction is phased include phasing plan and schedule for each area.
- C. List of Nurseries: Submit list of nurseries that will be supplying plant material for the project.
- D. Maintenance Instructions: Submit typewritten instructions recommending City of Buckeye's maintenance efforts subsequent to Landscape Contractors' 90 DAY PLANT ESTABLISHMENT PERIOD, and for the ONE YEAR PLANT WARRANTY period and year thereafter.
- E. Decomposed granite: Contractor to submit a five-pound sample of Decomposed granite showing each gradation and color. Verify in writing to City of Buckeye's Representative that there is sufficient supply from a single source to supply the project. Contractor to submit material certificate signed by material producer and Contractor, certifying that Decomposed granite complies with or exceeds specified requirements.
- F. Angular Rock: Contractor to submit samples of 3" to 8" sized rock showing color that is similar to the "Decomposed granite". Verify in writing to City of Buckeye's Representative that there is sufficient supply from a single source to supply the project. Contractor to submit material certificate signed by material producer and Contractor, certifying that Angular Rock complies with or exceeds specified requirements.

1.04 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with five (5) consecutive years of documented experience.
- B. Installer Qualifications: Company specializing in installing and planting the plants with five (5) consecutive year's experience.
- C. City of Buckeye's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request of the City of Buckeye's Representative. Rejected materials shall be immediately removed from the site at Contractor's expense. Contractor shall pay cost of testing of materials not meeting specifications.
- D. Plant Material: Provide trees of quantity, size, genus, species, and variety shown and as scheduled for landscape work; and comply with recommendations and requirements of PART 1 "References". Provide healthy, vigorous stock, grown at a recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, or disfigurement.

Measure plant materials with branches or trunks in their normal position, and in conformance with requirements with the above 1.01 REFERENCES. Do not prune to obtain required sizes. Measure main body of tree for height and spread dimensions.

Plants shall be sound, healthy, well branched and densely foliated when in leaf. They shall have healthy, well-developed root systems and shall be free from evidence of physical damage or adverse conditions that would prevent thriving growth.

Plants shall not be pruned before delivery. Trees that have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4" that have not completely callused, will be rejected.

- E. Inspection: City of Buckeye's Representative may inspect plant material either at place of growth

or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. City of Buckeye's Representative retains right to further inspect plant material for size and condition of the roots and rootball, insects, injuries and latent defects, and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected plant material immediately from project site.

1.05 REGULATORY REQUIREMENTS

- A. Perform work in accordance with all applicable laws, codes and regulations required by authorities having jurisdiction over such work. Provide for all inspections and permits required by Federal, State and local authorities in furnishing, transporting and installing materials as shown or for completing the work identified herein.
- B. All plant material shall be certified that they are free of disease and hazardous insects.
- C. An individual licensed to perform this work shall apply all pesticides and herbicides.

1.06 DELIVERY, STORAGE AND HANDLING

- A. A temporary storage yard for plants or equipment used on the project may be placed at an on-site storage location, as approved by the General Contractor. Should the Landscape Subcontractor elect to store plants and equipment on the site, he/she shall be responsible for enclosing the yard with a 6 foot chain link fence and meet all requirements for the protection of occupational and public health and safety by agencies having jurisdiction over such matters.

The storage area shall have a lockable gate for which the General Contractor will be provided a workable key for the duration of the storage yard existence. No flammable fuels or explosives are permitted in the yard.

The Landscape Subcontractor shall be responsible for delivering water to the plants stored in the yard. The General Contractor shall approve the watering methods used for the storage area.

The Contractor's shall hold harmless the City of Buckeye's Representative from potential claims arising from the use of the land, acts of vandalism, or delays resulting from theft or unauthorized removal of materials and equipment from the storage yard.

- B. **Packaged Materials:** Deliver packaged materials in containers shall show the weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Protect products/materials from weather or other conditions that would damage or impair the effectiveness of the product material.
- C. **Trees and Shrubs:** Do not prune prior to delivery unless otherwise approved by City of Buckeye's Representative. Do not bend or bind-tie plant material in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. Provide adequate protection for root systems and balls from drying winds and sun.

Deliver plant material after preparations for planting have been completed and plant immediately. If planting is delayed more than six hours after delivery, set trees in shade, protect from weather and mechanical damage, and keep roots moist by an acceptable means of retaining moisture. Water as often as necessary to maintain root system in a moist condition

- D. Do not remove container-grown stock from container until planting time.

1.07 SOURCE QUALITY CONTROL

- A. Ship materials with certificates of inspection required by governmental authorities. Comply with regulations applicable to materials herein.

- B. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability from five sources to City of Buckeye's Representative, together with proposal for use of equivalent material with corresponding adjustment of contract price.

1.08 SITE CONDITIONS

- A. Water: Water will be provided by the Contractor through an accepted backflow preventer for the irrigation system (constructed as part of this project) for use in the landscape installation at no charge to the Landscape Subcontractor. Water will not be available on-site until tap is made for irrigation system and backflow preventer is installed, inspected, and approved.
- B. Site Examination: The prospective Contractors are encouraged to examine the plans and visit the job site prior to bidding on this project and to satisfy their concerns as to the magnitude of the work involved, to become aware of the existing conditions and to understand any restrictions to the completion of the proposed work. Failure to visit the site and acquaint himself with the existing conditions shall in no way relieve the Contractor from any obligation with respect to his proposal.
- C. Final Grade: The Contractor shall be responsible for finish grades shown on the plans.
- D. Utilities: Determine location of underground utilities through Blue Stake and perform work in a manner that will avoid possible damage. Hand excavate, as required. Repair or replacement of damaged utilities shall be made as directed by the City of Buckeye's Representative. The costs of repairs or replacement of utilities damaged by the actions of the Contractor shall be borne by the Contractor.
- E. Obstruction: If rock, underground construction or other obstructions are encountered in preparation of landscape areas or during plant pit excavation, the Contractor is to the notify City of Buckeye's Representative. Instructions may be issued to direct removal of obstruction to a depth of not less than 6" below required planting depth. Proceed with work only after approval of City of Buckeye's Representative.

1.09 SAMPLES AND TEST

- A. The City of Buckeye's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples as identified in this Section and upon request by the City of Buckeye's Representative. Rejected materials shall be immediately removed from the site at Contractor's expense. Contractor shall pay the cost of testing of materials not meeting specifications.
- B. Label each type of plant with a securely attached waterproof tag bearing legible designation of botanical and common name.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Planting Seasons and Conditions: Planting shall not be done when the soil is muddy or conditions are otherwise unsuitable for planting. The City of Buckeye's Representative will be the sole judge of the acceptability of the site soil and conditions for planting.

1.11 WARRANTY

- A. Warranty all plant materials against defects due to any cause for a period of one (1) year from the Date of Landscape Substantial Completion and commencement of the formal Landscape Establishment Period.
- B. This warranty will not be enforced should plant material die due to vandalism, improper

maintenance procedures (including over- or under- watering), over-fertilization, non-removal of braces/guy wires causing girdling of trunks, fire, flood or hail, or other similar circumstances beyond the control of the Contractor.

- C. Replacements: Replace plant materials when they are no longer in satisfactory condition as determined by the City of Buckeye's Representative during the warranty period. Make replacements within fourteen (14) days of notification by the City of Buckeye's Representative. Plant replacement materials of same size and species as originally specified, with a new warranty commencing on date of replacement. Remove dead plants within seven (7) days of notification. Replacements shall be made at no expense to the City of Buckeye.

1.12 PLANT ESTABLISHMENT PERIOD

- A. From the time any plants and turf are planted until completion of the Ninety (90) Day Plant Establishment Period, the Contractor shall ensure that all plants are watered, trash and debris are removed weekly, weeds controlled, plant replacements made, plants pruned, and/or spraying for insects or disease completed. Traffic control, if required during the maintenance period, shall be included in the cost of contract items.
- B. Spray or dust appropriate insecticides, miticides and fungicides as necessary to maintain plants in healthy and vigorous growing condition until accepted by the City of Buckeye's Representative. Apply pest and disease control chemicals in accordance with manufacturer's instructions. Contractor will bear full responsibility for complete removal of weeds and grasses such as Dallas, Bermuda, Johnson and Nut from the project site.
- C. Make replacements of dead or unhealthy plants for any reason during the Ninety (90) Day Plant Establishment Period except for replacements resulting from the exclusions identified in PROJECT WARRANTY above. Plants damaged by frost shall be replaced during the maintenance period as directed by the City of Buckeye's Representative; there shall be no limit to the replacements due to frost. City of Buckeye's Representative shall approve replacement plants prior to planting.
- D. Provide a schedule of maintenance activities to the City of Buckeye's Representative prior to starting the 90 day establishment period. Provide the City of Buckeye's Representative with weekly reports summarizing maintenance activities completed by the Contractor, including person hours expended to complete the tasks.
- E. Lack of care or plant neglect during the 90 day establishment period: Each day during which the City of Buckeye's Representative determines that work under the Plant Establishment Period is required and the Contractor is so advised, and the Contractor fails to accomplish the required work, the subject days will extend the 90 day maintenance and the warranty period.
- F. Final Maintenance Inspection: At the end of the Ninety (90) Day Plant Establishment a final maintenance inspection will be performed to accept the landscape installation for the remaining warranty period. At the time, the Contractor shall have all planting areas under this Contract free of weeds and neatly cultivated. All plants shall be alive and healthy, without signs of stress.

If, after the inspection, the City of Buckeye's Representative is of the opinion that all work has been performed as per the drawings and specifications and that all plant materials are in satisfactory growing condition, he will give the Contractor written notice of final acceptance of the landscape installation and commencement of the one (1) year warranty period.

Work requiring corrective action or replacement in the judgment of the City of Buckeye's Representative shall be performed within ten (10) days after inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications, and shall be made by the Contractor at no cost to the Project. Maintain corrected work until re-inspected by City of Buckeye's Representative. The Contractor shall be responsible for replanting, weeding,

and maintaining the landscaping until acceptance of the (90) Day Plant Establishment period. The City of Buckeye's Representative shall be the sole judge of acceptance of the 90 Day Plant Establishment Period.

- G. The remainder of the 1 Year Plant Warranty will extend 275 days beyond acceptance of the 90 Day Plant Establishment period, during which time the City of Buckeye is responsible for landscape maintenance. However, plant replacement may still be enforced, pending circumstances beyond City of Buckeye maintenance.

PART 2 PRODUCTS

2.01 TREES, SHRUBS, GROUNDCOVERS, CACTI AND SUCCULENTS

- A. Trees, shrubs, groundcovers and cacti and succulents: Shall be nursery grown, plantation grown or collected stock from on/off-site, as noted on the plans, conforming to ANSI Z60-1 and shall be of the varieties specified in the plant list bearing botanical names listed in the AJCHN-SPN publication. Planting stock shall be well-branched and well-formed, sound, vigorous, healthy and free from disease, sunscald, windburn, abrasion and harmful insects or insect eggs and shall have healthy, normal, and unbroken root systems and shall bear evidence of conformance with the Arizona Native Plant Law. Trees shall be symmetrically developed, of uniform habit of growth, with straight poles or stems, and free from objectionable disfigurements. Trees shall have been grown under climatic conditions similar to those in the locality of the project.
- B. The minimum acceptable sizes of all plants, measured before pruning and with branches in normal position, shall conform to the measurements indicated in the plans or noted references. Plants larger in size than specified may be used as approved. If larger plants are used, the spread of roots shall be increased in accordance with ANSI Z60.1.
- C. Plants shall be dug and prepared for shipment in a manner that will not cause damage to branches, shape and future growth after planting.
- D. Container grown plants shall have sufficient root growth to hold the earth intact when removed from the containers but shall not be root bound.

2.02 SOIL AMENDMENT MATERIALS

- A. Forest Mulch: Shall be well-composted, nitrogen-stabilized wood fiber mulch with a carbon to nitrogen ratio of 30:1 available from Western Agricultural Products, Phoenix, Arizona, or approved equivalent.
- B. Plant Tablets: Shall be Agriform 21 gram, 20-10-5 fertilizer tablets or approved equivalent.
- C. Soil Sulfur: Shall be a commercial-grade product produced for the intended use. Sulfur shall be approved prior to use on the project.
- D. Bactericide: Shall be applied in accordance with manufacturer's recommendations.
- E. Herbicides and Pesticides: Contact herbicides and pesticides use must comply with all applicable state and federal laws and be registered with the U.S. Environmental Protection Agency. Contact herbicides shall be quick acting and permit planting within 7-10 days of their use.
- F. Sand: Shall be commercial grade mortar sand.

2.03 INERT MATERIALS

- A. The Inert material(s) placement, i.e. decomposed granite, angular rock, and boulders shall be type and size specified on landscape plans.
- B. The decomposed granite shall meet MAG Section 795 and shall not contain lumps or balls of clay, caliche, organic matter or calcareous coating. Decomposed granite shall be placed in all planting areas shown on plans. Provide documentation that sufficient quantity (for each type of decomposed granite shown on the plans) is available to complete the project from a single source.

2.06 ACCESSORIES

- A. Stakes and rubber hose Strap Tie: Provide stakes of sound new 2" diameter by 8' or 10' (see plant details) Cedar, Redwood or Lodge Pole Pine, free of knotholes and other defects. Provide ½" reinforced garden hose with 12 AWG double stranded wire, manufactured for the purpose of tying tree to stakes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Inspection and Review: Contractor is to verify site conditions and note any irregularities affecting his/her work of this section. Contractor is to report any irregularities to the City of Buckeye's Representative prior to beginning work. Contractor shall verify that grading or other site work is complete enough prior to execution of work under this section. Beginning work of this section implies acceptance of current existing conditions.
- B. Contractor is to verify locations of all underground utilities. Coordinate with City of Buckeye's Representative, and contact Blue Stake as needed. Placement of electrical, irrigation, and other underground utilities will be reviewed with the General Contractor and Landscape Contractor prior to commencement of work. Conflicts will be brought to the attention of the City of Buckeye's Representative for resolution.

3.02 TREE, SHRUB AND GROUNDCOVER PLANTING

- A. Clearing and grading: All planting areas shall be free of construction material and subgrade elevations established to permit landscape construction. No planting shall be done when the soil is excessively wet in the opinion of the City of Buckeye's Representative.
- B. Layout: Layout individual tree locations and secure City of Buckeye's Representative's acceptance before start of planting work. Make minor adjustments as may be requested.
- C. Excavation: Plant pits shall be dug to produce vertical sides with a flat bottom, sides and bottom shall be scarified, or as shown on the drawings. If pits are dug with an auger and the sides of the pits become glazed in the opinion of the City of Buckeye's Representative, the glazed surface shall be scarified. Loosen hard subsoil in bottom of excavation.
- D. Test drainage of planting pit by filling with water twice in succession. Plant pits retaining water for more than 24 hours shall be brought to the attention of the City of Buckeye's representative. Submit in writing, a proposal for correction, before proceeding with any planting operations.
- E. If caliche is encountered the Contractor is to break through the caliche to provide drainage and/or bring to the attention of the City of Buckeye's Representative for resolution.
- F. Plant tablet schedules for trees shall be per manufacturer's recommendation.
- G. Backfill Mix: Refer to the backfill mix requirements herein. To be acceptable the backfill shall have all stones greater than 1-inch diameter removed and without dirt balls, clumps or layers of

individual materials. Prior to the backfilling of holes, the Contractor shall provide a sample of the backfill for the City of Buckeye's Representative to review. This sample shall be used as reference material for the backfill as the project proceeds.

- H. **Setting and Backfilling for Trees:** Set plant stock on undisturbed soil, plumb and in center of pit with top of ball at elevation set to finished landscape grades. Remove boxes, including bottom, or containers before setting. Do not use stock if root ball is cracked or broken prior or during planting operations. When set, place additional backfill around base and sides of ball and place plant tablets. Work each layer to settle backfill and eliminate voids and air pockets. When planting pit is approximately 2/3-full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water soil again after placing final layer of backfill.

Cut plastic or metal containers on 2 sides with a metal cutter. Do not use spade to cut cans. Do not handle container plants by foliage, branches or trunks. After removing plant from container, scarify side of rootball to eliminate root-bound condition.

Remove all nursery-type plant stakes and labels from plants. Install tree staking per drawings.

- I. **Staking of Trees:** Stake and tie trees per project details
- J. **Watering:** All watering shall be done in a manner which will provide uniform coverage but which will not cause erosion or damage to the finished surface.
- K. **Pruning:** Prune, thin out and shape trees in accordance with ASNS. Prune trees to retain required height and spread. Do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune trees to retain natural character. Plants should conform to the requirements of ANA after pruning.
- L. **Herbicide and Pesticide Application:** Herbicides, insecticides and fungicides shall be applied as needed and in accordance with the manufacturer's recommendations and applied by a licensed professional.

3.03 CACTI AND SUCCULENTS

- A. **Installation of Cacti and Succulents:** Lay out individual Cacti and Succulents locations. Stake locations, outline areas and secure City of Buckeye's Representative acceptance before start of planting work. Make minor adjustments as may be requested by City of Buckeye's Representative.
- B. **Excavation:** Excavate pits, as shown on drawings and schedules. Loosen hard subsoil in bottom of excavation.

If caliche is encountered the Contractor is to break through the caliche to provide drainage and/or bring to the attention of the City of Buckeye for resolution.
- C. **Preparation of Cacti and Succulents Backfill Mix:** Soil removed from the plant pit shall be mixed with sand at a ratio of 30% - 40% sand and 60% - 70% excavated on site native soil.
- D. **Marking and Calibration for Cacti:** Prior to delivery to the site and planting, the Contractor shall mark the original north appearing surface and also establish calibration points. Record distance between calibration marks of all cacti using a method acceptable to the City of Buckeye's Representative. The mark or its installation process shall not damage or deface the cacti. The mark must be capable of withstanding poor weather and expected working conditions without the possibility of erasure or detachment throughout the duration of the contract.

All wounds and/or cuts made to the Cacti and Succulents shall be treated with bactericide as approved on the same day that the cut and/or wound was made.

All cut and/or damaged roots shall be treated with dusting sulfur as approved on the same day that the cut and/or wound was made.

3.04 INERT MATERIALS INSTALLATION

- A. The areas on which Inert Materials are to be placed shall be graded according to the drawings prior to placement. The ground shall be reasonably smooth and firm and all deleterious material and rocks larger than 1" in diameter shall be removed and disposed of off-site.
- B. The Contractor shall field identify placement area by outlining the perimeter each type of inert material identified on the plans by flagging, staking, or surface spray paint. In addition landscape mass planting areas and groupings shall also have an identified perimeter.
- C. In areas to receive inert mulch apply **TWO** applications of pre-emergent weed control, such as Surflan, or equal. The first application shall be prior to placement of inert material. The 2nd application shall be applied to the finish surface of these areas as described below.
- D. Decomposed granites shall be wetted prior to placement over accepted subgrade to eliminate powdering and dry placement. The decomposed granite shall not be mixed with, and shall be protected from contamination with on-site soil materials or other undesirable materials prior to placement. Decomposed granite that, in the opinion of the City of Buckeye's Representative, has undesirable contaminants shall be removed from the project.
- E. Decomposed granite shall be placed where designated, per the drawings including plant irrigation saucers.
- F. After placement and raking of the decomposed granite, the Contractor shall lightly spray to remove fines from the surface and water settles the material.
- G. Angular Rock shall be placed so as not to disturb or damage the plant.
- H. A second application of pre-emergent herbicide shall be applied to decomposed granite areas in accordance with the manufacturer's printed instructions. Following this application the Contractor shall water-in the pre-emergent herbicide per the manufacturer's recommendation, so that it saturates into inert material and soil.

3.05 CLEAN-UP AND PROTECTION

During landscape work, keep pavements and work area in a clean, neat and orderly condition. Broom, scrub or hose affected areas as directed by City of Buckeye's Representative. Soil deposits or compacted mud will not be allowed to remain on the roads, parking lots or concrete surfaces, and shall be removed daily or more frequently as directed by the City of Buckeye's Representative.

Protect landscape work and existing improvements from damage due to landscape installation, or the operations of other Contractors and trespassers. The Contractor assumes all responsibility for the portion or portions of the site under construction and shall provide and maintain safety devices and protective equipment as required by state and local laws, codes and ordinances. Maintain protection during installation and maintenance periods as required. Treat, repair or replace Contractor damaged work as directed by the City of Buckeye's Representative at no cost to the City of Buckeye's Representative. Remove all debris, trash and excess materials generated by the landscape installation and properly dispose of it.

END OF SECTION

SECTION 33 44 16

TRENCH DRAINS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Manufactured trench drains, fittings and trench drain grating covers as shown on Drawings and as specified herein.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, design data and installation instructions.
- B. Certificates: Submit manufacturer certification that products furnished meet specification requirements.
- C. Contract Closeout Submittals: Submit the following in accordance with Section 01 77 00.
 - 1. Project Record Documents: As-built drawings indicated final location and elevation of trench drainage piping.
 - 2. Certification: Certification signed by Contractor indicating that drain pipe system was successfully tested for proper operation and drainage.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
 - 1. ACO Polymer Products, Inc. www.acousa.com
 - 2. Polydrain Systems, ABT Inc. www.abtdrains.com
 - 2. Zurn Plumbing Products Group www.zurn.com

2.02 MATERIALS

- A. Trench Drain System: Poly-lock built-in with lock strap and cast-iron slotted grate No. 502 as manufactured by Polydrain Systems, or equivalent from one of the specified manufacturers, as approved by Architect.
- B. Preformed polyester fiberglass, polymer concrete, or cast-iron body, pre-sloped drainage system with 1 percent minimum per foot bottom slope.
 - 1. Width: As indicated on Drawings.
 - 2. Length: 6 foot minimum lengths with interlocking ends.

3. Frame: Hot-dipped galvanized steel with corrosion resistant protective coating.
4. Grate: Commercial Vehicle Classification slotted cast iron grate with grating lock downs and optional heavy duty frame.
5. Provide manufacturer standard anchor tabs, leveling devices, interlocking ends, pipe couplings and fittings as required to install and connect trench drainage system to storm drainage line.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
- B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

- A. Surface Preparation: Remove debris and soil materials larger than 6 inches in size and provide level base at excavation to receive trench drainage system.

3.03 INSTALLATION

- A. Set units in place with anchor tabs and leveling devices. Slope units for proper drainage, as indicated on Drawings, to storm water collection system. Refer to Civil Drawings.
- B. Adequately support and brace units in proper position within concrete slab formwork with top of units set so grate will be flush with finished concrete surface.
- C. Connect drain system to storm drainage system with manufacturer's standard couplings and fittings without leaks.
- D. Place compacted fill materials complying with Section 31 00 00 around set and braced drain system to achieve proper concrete thickness below and on sides of system.
- E. Water Testing: Water test trench drainage system prior to placement of concrete to assure free flow without obstruction or back-up. Re-set drains, replace damaged components, and retest system until proper drainage is obtained.
- F. Secure grate covers with stainless steel anchors. Grate covers shall be flush with adjacent finished concrete surface with proper flow of runoff water from concrete surfaces to drainage system.

3.04 CLEANING

- A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF SECTION