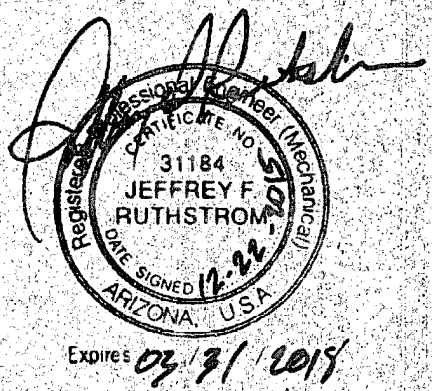
C-10781

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

PROJECT NO. 141510

CITY HALL COOLING TOWERS REPLACEMENT

January, 2016



GLENDALE

CITY OF GLENDALE

ENGINEERING DEPARTMENT
5850 W. Glendale Avenue, Glendale, Arizona 85301 (623) 930-3630

GLENDALE

Engineering Department
Memorandum

DATE: January 13, 2016
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 141510 – COOLING TOWERS REPLACEMENT

ADDENDUM NO. 1

In accordance with the contract documents "Information for Bidders," Page 4, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

Pearson Engineering Associates, Inc. offers the following Project Clarifications to the City of Glendale City Hall Cooling Tower Replacement Project. All attached project clarifications, drawing revisions, and Contractor questions must be included in the project bid estimates submitted to the City of Glendale.

General Project Clarifications

1. **NEW bid date and time:** Wednesday, January 20th at 2:00 pm.

2. Replace "Bid Schedule" within Project Specifications and Bid Documents (Page 8) with attached "Revised Bid Schedule", dated January 13, 2016.

3. Pre-bid sign-in sheet is included as an attachment for your information.

Questions and Answers

QUESTION 1
Sheet A-6 of 26 note 14 – notes landscaping by others. Does this mean landscaping not to be in contract? Is contractor to coordinate with owner's landscaper?

Answer
Area indicated on the Contract Documents to be infilled as directed on the drawings and provided with DG to match existing exterior landscape.

QUESTION 2
Please reference the plan sheet index. Sheet E-5 panel schedules and electrical details are missing. Will they be provided?

Answer
See attached missing Sheet E-5 to be added to design documents.

Registered Professional Engineer (Mechanical)
CERTIFICATE NO. 31184
JEFFREY F. RUTHSTROM
DATE SIGNED 1/14/16
ARIZONA, U.S.A.
Expires 09/30/2018

QUESTION 3
A soils report appears to be missing, will this be provided?

Answer
Soils report shall be part of contract document. See attached soils report by Speedie and Associates.

QUESTION 4
Engineering for the caisson depth seems to be missing. Is the contractor or owner to pay for engineering? The depth of the caissons is not specified?

Answer
The depth of the caissons and requirements are indicated on the Soils Report and also indicated on the Structural drawings. Refer to Soils Report and Structural Design Drawings for further information. Structural Calculations shall be part of contract documents. (See Caruso Turley Scott attachment.)

QUESTION 5
Is the electrical conduit for light fixtures to be run in the new CMU wall for specified light fixtures? The light fixture indicated on the design drawings is not recommended for areas where direct water can be sprayed upon the polycarbonate lens.

Answer
The electrical conduit can be run exposed along the new wall in lieu of inside the new CMU wall. Light Fixture shall be bid as per plan. Should an alternate be required it will be addressed during construction.

QUESTION 6
It appears that construction materials sampling and testing is missing from the specifications book, page 43. Is there a way we can obtain this information contractor or owner to pay for? Types of testing required?

Answer
Material testing (soils compaction and concrete compressions, etc.) shall be provided by the City of Glendale. Types of testing shall be per the requirement as indicated in Specification Section 033000 Cast-In-Place Concrete and Section 042200 Concrete Unit Masonry.

Drawing Revisions and Clarifications (ASI #1)

1. Architectural (Addendum 001) – See attached Addendum 001 letter and drawing revisions that represents changes to the Contract Documents. All revisions are clouded and identified as Delta 2 and dated January 8, 2016.

2. Mechanical (Addendum 001) – Sheet M-1 "Cooling Tower Schedule", the OSA WB (degrees F) to be changed to 76.8 degrees F in lieu of 78 degrees F as indicated in the Contract Documents.

3. Mechanical (Addendum 001) – Sheet M-1 "Cooling Tower Schedule", in the Remarks are the words "Evertough Construction" to be removed from the Remarks.

(PLEASE SEE ATTACHMENTS)

This Addendum consists of fifty-six (56) pages not including two-page cover.
END OF ADDENDUM

CITY OF GLENDALE

PROJECT NUMBER: 141510

PROJECT: CITY HALL COOLING TOWERS REPLACEMENT

REVISED JANUARY 13, 2016

REVISED BID SCHEDULE

BASE BID

ITEM NO.	DESCRIPTION	QTY	TOTAL COST
A	Mobilization / Demobilization	LS	
B	Demolition	LS	
C	Architectural	LS	
D	Concrete	LS	
E	Structural & Misc. Steel	LS	
F	Plumbing	LS	
G	Mechanical	LS	
H	Electrical	LS	
I	Controls	LS	
J	Misc. Items	LS	
K	Owner's Contingency	LS	**$75,000.00**
	BASE BID COST:		

ALTERNATE #1

A	Furnish and Install Circulating Pumps	LS	
	TOTAL ALT. #1 & BASE BID COST:		

Project #141510 – CITY HALL COOLING TOWERS REPLACEMENT
January 7, 2016 – 9:00 A.M.
JOBSITE

Name (Please PRINT)	Representing	Email Address	Phone
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Rich Dewane	Hayes Mechanical	rdewane@hayesmechanical.com	602 751 8764
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Vince Palermo	Benson Systems	Vince.palermo@bensonsys.com	480-737-0112
BRADY NOTBOHM	CTS	bnotbohm@ctsaz.com	480-774-1709
Keith Heywood	Heywood Building	Keith@HeywoodBuilding.com	602-757-2359
Greg Bosvee	PCE	greg@pceaz.com	602-499-0595
Mike Joyce	Newcomb Mech	MJoyce@Newcomb Mechanical.com	602 377-8767
Jim Lindell	Kinetics KINETICS	Jim.Lindell@kinetics.net	602 695 2422
Mark Cebrynski	Helios Systems LLC	mark@HeliosAZ.com	480-620-6254
Riley BROUGHTON	PROCHEMTECH	riley.prochemtech@hotmail.com	480 529 8370
MITCH CLARK	Comfort Systems	mclark@comfortsystemsusa.com	602 558 1618
Jerry Chandler	Arizona Specialty Demolition	Jerry@azspecialtydemo.com	602 510 3540
Ed NANCE	EXTREME Drywall	ed@extremedrywallconcepts.com	
Jim Heathcot	Pro Chem Tech	Rhoby20@cox.net	480 621 0188
Ed Perez	Belaire Mech	eperez@belairemechanical.com	480-266-2780
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CRIS CARUSO	CARUSO Construction	CRIS.CARUSO@CARUSOconstruction.com	602 695 2422

Name (Please PRINT)	Representing	Email Address	Phone
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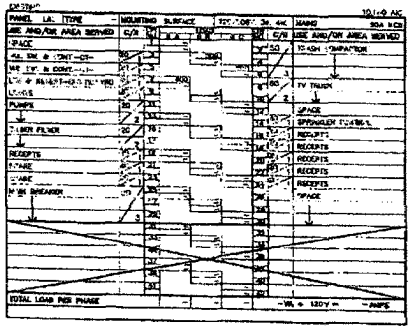
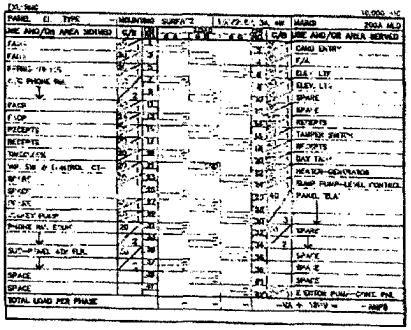
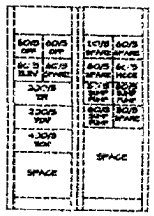
Les Jaeger	IMCOR	les.jaeger@imcor-az.com	602-763-4511
[illegible]	BSC	[illegible]	602 [illegible]
Don Quirin	Uni-Tech	Don@uni-Tech.com	480 232 8456
Victor Lomas	RKS Plumbing	vlomas@RKSplumbing.com	602 3764780
JOHN KOVACH	RKS	JKOVACH@RKSPLUMBING.COM	602 996-1862
Scott Liversedge	RKS	sliversedge@RKSplumbing.com	602-361 4248
Scott CABRAL	COG	SCABRAL@GUIDAVEAZ.com	602-320-8790



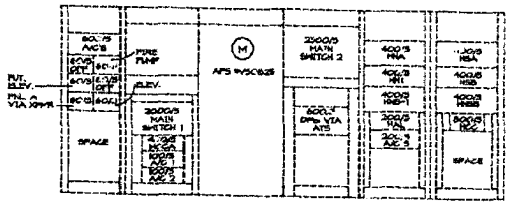




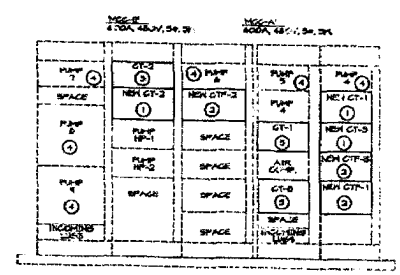
SWITCHBOARD 'DPE'
N.T.S.

PANEL SCHEDULE LEGEND (ALL SYMBOLS MAY NOT BE USED)

- ACTUAL LOAD AT 120m PER CODE
- TIME CLOCK CONTROLLED CIRCUIT
- TIME CLOCK/PHOTO CELL CONTROLLED CIRCUIT
- SHUNT TRIP TYPE CIRCUIT BREAKER
- SWITCH RATED TYPE 'SWD' CIRCUIT BREAKER
- CIRCUIT BREAKER WITH LOCKING DEVICE
- GROUND FAULT CIRCUIT INTERRUPTER TYPE CIRCUIT BREAKER
- EXISTING CIRCUIT BREAKER & LOAD
- NEW CIRCUIT BREAKER & EXISTING LOAD
- EXISTING CIRCUIT BREAKER & NEW LOAD
- NEW CIRCUIT BREAKER & LOAD
- EXISTING SPARE CIRCUIT BREAKER TO REMAIN
- EXISTING CIRCUIT BREAKER WITH LOAD REMOVED - TO BECOME SPARE
- CIRCUIT BREAKER HANDLE TIE.



SERVICE ENTRANCE SECTION
N.T.S.



GE 8000 LINE MOTOR CONTROL CENTER
N.T.S.

1. INSTALL NEW STARTER/DISCONNECT SIZE L IN TABLE FOR 10HP,480V, 3Ø, 30A-3P DISCONNECT FUSED AT 25AMPS
2. INSTALL NEW STARTER/DISCONNECT, SIZE G, SUITABLE FOR 3 HP, 480 V, 3,Ø DISCONNECT FUSED AT 6 AMPS
3. EXISTING COOLING TOWERS/WALL REMAIN IN SERVICE UNTIL NEW TOWERS ARE ON LINE. EXISTING STARTERS SHALL BECOME SPARE. COORDINATE WITH MECHANICAL CONTRACTOR.
4. ADD ALTERNATE #1- SEE SHEET E-4.

PEARSON ENGINEERING ASSOCIATES, INC.
7125 N. 22ND AVENUE
PHOENIX, ARIZONA 85021
PHONE (602)264-0707
FAX (602) 264-3644
WEB SITE: www.pearson-eng.com
DESIGNER: WSH
PROJECT NO: 2013013

CITY OF GLENDALE
ENGINEERING DEPARTMENT
5850 W. GLENDALE AVE.
GLENDALE, ARIZONA 85301 (623) 830-3630

Expires 9/30/17

Designed	Drawn	Checked	Reviewed
WSH	MRJ	MJM	

No.	Date	Description

REVISIONS

141510
59th & Glendale Avenue
City Hall Cooling Tower Replacement
5850 West Glendale Avenue

602.263.1100

SHT. E-5
OF 26

#151535

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

www.speedie.net

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Glendale City Hall Cooling Tower

LOCATION: 5850 W. Glendale Avenue
Glendale, Arizona

CLIENT: Caruso Turley Scott, Inc.

PROJECT NO: 151538SA

DATE: October 20, 2015

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 10/20/15
ARIZONA, U.S.A.
Expires 03/31/17

3331 East Wood Street ▪ Phoenix, AZ 85040 ▪ Phone (602) 997-6391 ▪ Fax (602) 943-5508
4025 East Huntington Drive, Suite 140 ▪ Flagstaff, AZ 86004 ▪ Phone (928) 526-6681 ▪ Fax (928) 526-6685
3125 E. 47th Street ▪ Tucson, AZ 85713 ▪ Phone (520) 514-9411 ▪ Fax (520) 514-9474

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

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APPENDIX - Field and Laboratory Data

1.0 INTRODUCTION

This report presents the results of a geotechnical subsoil investigation carried out at the site of the proposed Glendale City Hall Cooling Tower located at 5850 W. Glendale Avenue in Glendale, Arizona.

Preliminary information calls for the construction of a new cooling tower with a drilled shaft foundation and grade beams. Structural loads are expected to be light to moderate and no special considerations regarding settlement tolerances are known at this time. Adjacent areas will remain landscaped or paved to support moderate passenger and light truck traffic.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is bounded on the north and east by an existing building, on the south by W. Glendale Avenue, and on the west by an existing cooling tower. It is understood that the existing cooling tower we be demolished prior to new construction. The site currently consists of a concrete paved walkway and landscaped area with several trees and light poles.

2.2 Geological Conditions

The site is located within known areas that have undergone significant 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, and no fissures have been discovered within the immediate vicinity. 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 Luke Air Force base, approximately 10 miles west of this site. Based on local experience, subsidence and earth fissures historically have not been a problem in this area.

It is not known if subsidence at this site has stopped, if it is continuing, or at what rate it may be occurring. However, the absence of observable fissures indicates that the structural effects on buildings should be minimal. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which should not affect the type of buildings proposed for this site.

If any cracks, crevasses, or fissures are noted during site excavation this office should be notified immediately. Representatives from this office will then visit the site, assess the feature and make recommendations regarding restorative measures.

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 two 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, the geology in the area, Site Class Definition, Class D should be used for design of the structures. In addition, the following seismic parameters are provided for design based on 2008 USGS maps adopted by 2012 IBC):

Table 2.3.1 Seismic Parameters

MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.172g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.057g
Site coefficient, Fa:	1.2
Site coefficient, Fv:	1.7
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.275g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.137g
5% Damped spectral response acceleration, S_{DS}:	0.183g
5% Damped spectral response acceleration, S_{D1}:	0.091g
NOTES: 1. MCE = maximum considered earthquake	

2.4 General Subsurface Conditions

Subsoil conditions at the site consist of silty gravel with sand and cobble to depths of approximately 10 feet, underlain by sandy lean clay and clayey sand to the boring termination depth of 31.5 feet below existing grade. Subordinate amounts of gravel were also noted in the deeper profile. The Standard Penetration Resistance Test (SPT) values range from 13 to 32 blows per foot. 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 this investigation.

The deeper bearing soils have in-place densities on the order of 100.5 pcf and an observed water content of 17.9 percent at the time of investigation. Liquid limits are on the order of 38 percent with plasticity indices ranging from 18 to 20. These clayey soils display volume increase due to wetting of 2.6 percent when compacted to moisture and density levels normally expected during construction. The soils also exhibit minor additional compression due to wetting (hydro-consolidation) under a maximum load of 3,200 psf.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Due to the expected moderate concentrated loads adjacent structures with a lower level it is recommended to support the cooling towers and associated structures on drilled shafts (caissons) and grade beams. Using shallow spread footings would result in excessive settlement potential for surface structures. Some special site preparation will be required with respect to the existing structures, related elements, and underground utilities.

Excavation operations should be relatively straightforward using conventional equipment although the presence of cobbles may impede progress and possibly require the use of heavier equipment. Groundwater is not expected to be a factor in the design or construction of foundations and underground utilities.

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 conventional slabs-on-grade such as floors and sidewalks and lightly loaded foundations, but not enough to cause damage to heavier foundations. Typical recommendations to reduce (not eliminate) the swell potential include reducing the compaction requirements and requiring higher moisture contents during pad preparation and requiring at least 12-inches of non-expansive material (in addition to 4 inches of aggregate base) to be placed beneath the building slabs and slabs contiguous to the structure such as sidewalks and patios.

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. Large tree removal should include the major root ball. If required, any existing structures and foundation elements should be removed in their entirety along with soil disturbed by this activity. Carefully remove all concrete and other elements as well as any deleterious materials that may be encountered. Final grades should allow for the placement of 12 inches on non-expansive fill.

It is not known whether underground services related to the existing facility will be removed. If any utility is located within 5 feet of any proposed foundation, relocation and/or abandonment of the utility should be provided. They should either be removed and replaced with engineered fill or abandoned in-place. In the case of manholes and pipelines, it may be possible to abandon them in-place. The tops of manholes should be removed and filled with a weak (>500 psi) cementitious grout. Pipelines larger than 6 inches should be capped and filled with grout.

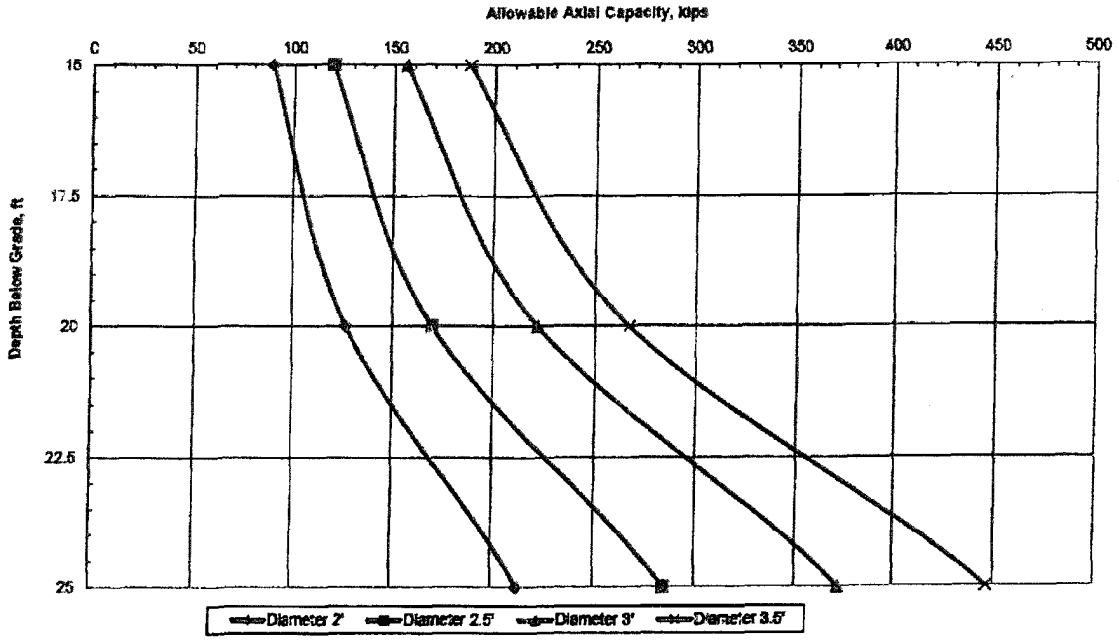
Prior to placing fill, the exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

3.3 Foundation Design

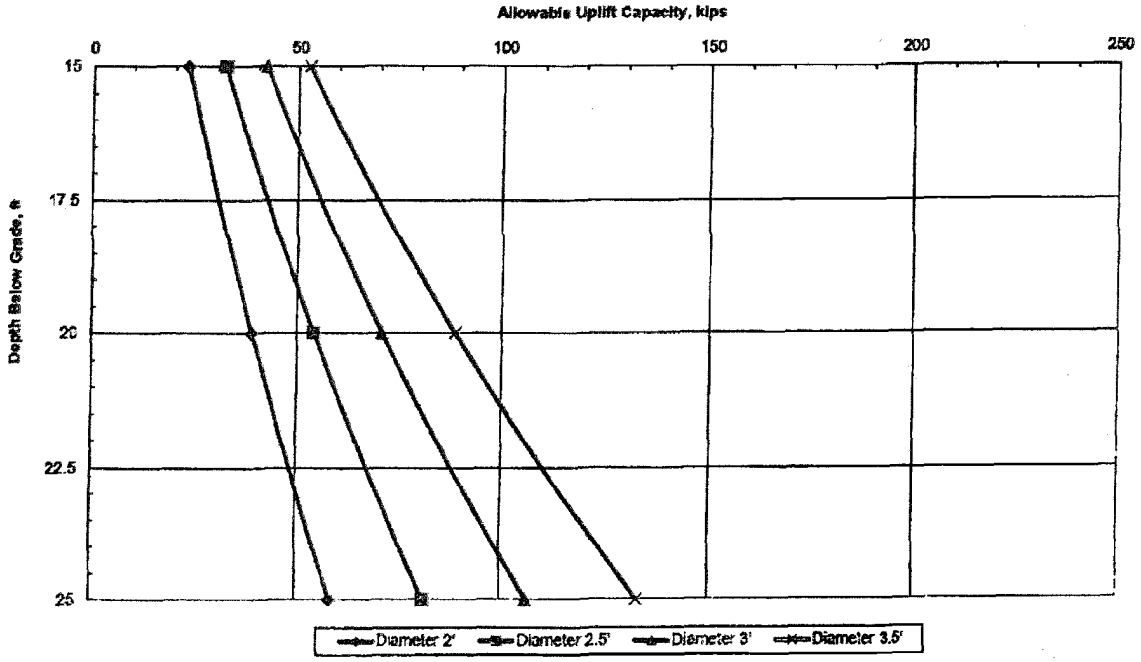
For any minor structures outside the wall backfill zone not to be founded on drilled shafts and grade beam an allowable bearing capacity of **1,500 psf** can be utilized for design. Bottom of footing excavation should be compacted to 95 percent of maximum dry density as determined by ASTM D-698. This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. **Positive drainage away from the proposed structure must be maintained at all times.**

For design of drilled shafts please refer to the following axial and uplift capacity curves:

Drilled Shaft Axial Capacity



Drilled Shaft Uplift Capacity



Drilled shaft settlement is expected to be on the order of 0.5 inches virtually all of which will occur during construction, depending on load, diameter and length. Additional localized settlements 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 **must** be provided to prevent ponding adjacent to perimeter walls. Planters requiring heavy watering should be considered with caution. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage.

Caissons should consist of drilled shaft foundations bearing in the hard/dense to very dense native soils. A minimum caisson length of 15 feet is recommended for at-grade structures. Design and construction should assume straight shaft caissons. Sloughing will likely occur in the sandy layers resulting in concrete quantities higher than neat dimension calculations. A minimum shaft diameter of 24 inches is recommended to allow access for cleaning and inspection. All caissons should be examined by a representative of the geotechnical engineer to verify cleaning, depth, dimensions and proper bearing strata. Straight shaft caissons may be "machine cleaned" provided the contractor can show the ability to adequately remove loose material. Adjacent caisson base (tip) elevations should not vary by more than 45 degrees.

A minimum allowable distance of 3 caisson diameters, center-to-center, is recommended between caissons for reasons of construction safety and to reduce axial group action. This limitation ensures that newly placed caissons are not damaged during the subsequent placement of adjacent caissons. This distance may be reduced to 2 diameters if one of the caissons has been in place for enough time to allow concrete to set and cure. A load bearing reduction factor of 0.7 should be applied to individual caissons within a proximity of two diameters, center-to-center, of each other. If adjacent caissons are of different diameters, an average of the diameters should be used for determining spacing. A separate set of group reduction factors should be applied for lateral load conditions. Speedie and Associates should be contacted if these are required. Alternatively, p-y modification factors can be used.

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 equivalent fluid 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 or Drilled Piers	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All footing 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 soils are considered suitable for use in general grading fills but should **not** be used in the top 12-inches of pad fill or as retaining wall backfill. The top 12-inches of 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 for under-slab 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) (Not recommended for the top 1 foot)	90-95 (max)
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. 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 may be carried out with native excavated material, provided that material greater than 3 inches is screened out. 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 under the slab 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.

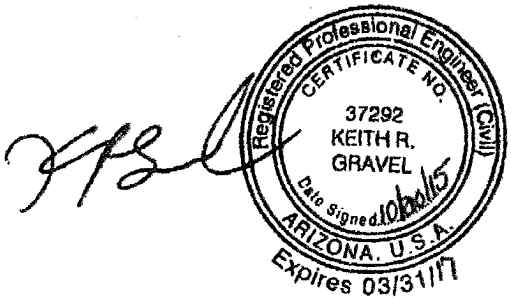
4.0 GENERAL

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.



Taylor S. Wilmsen, E.I.T.

Keith R. Gravel, P.E.

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CONSOLIDATION TEST

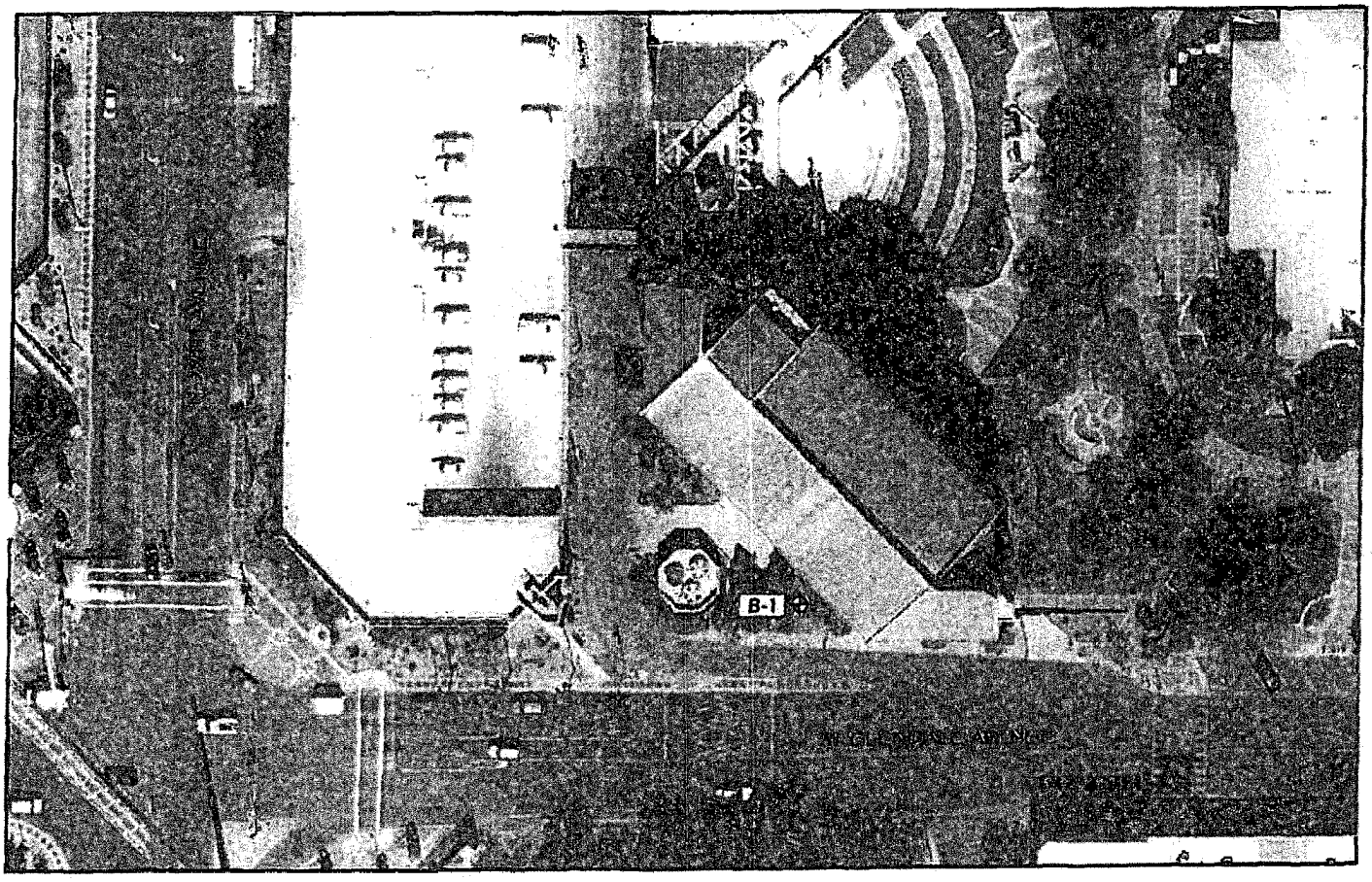
MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

FIELD AND LABORATORY INVESTIGATION

On September 29, 2015, 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 staff engineer, 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 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

SOIL BORING LOCATION PLAN

DR: TBW | REV: | CHK: | DATE: 10 / 09 / 15 | PROJECT NO 151538SA

GLENDALE CITY HALL COOLING TOWER
5850 W. GLENDALE AVENUE
GLENDALE, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS

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.

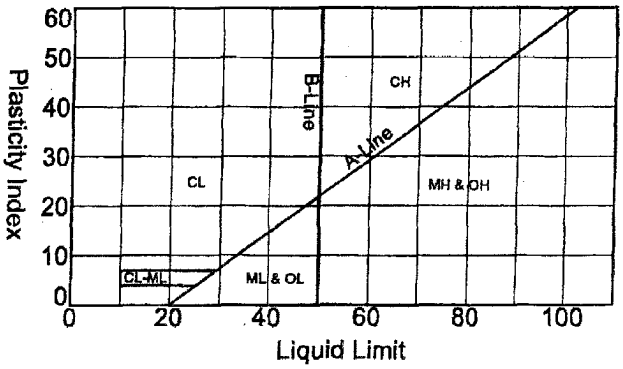
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard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

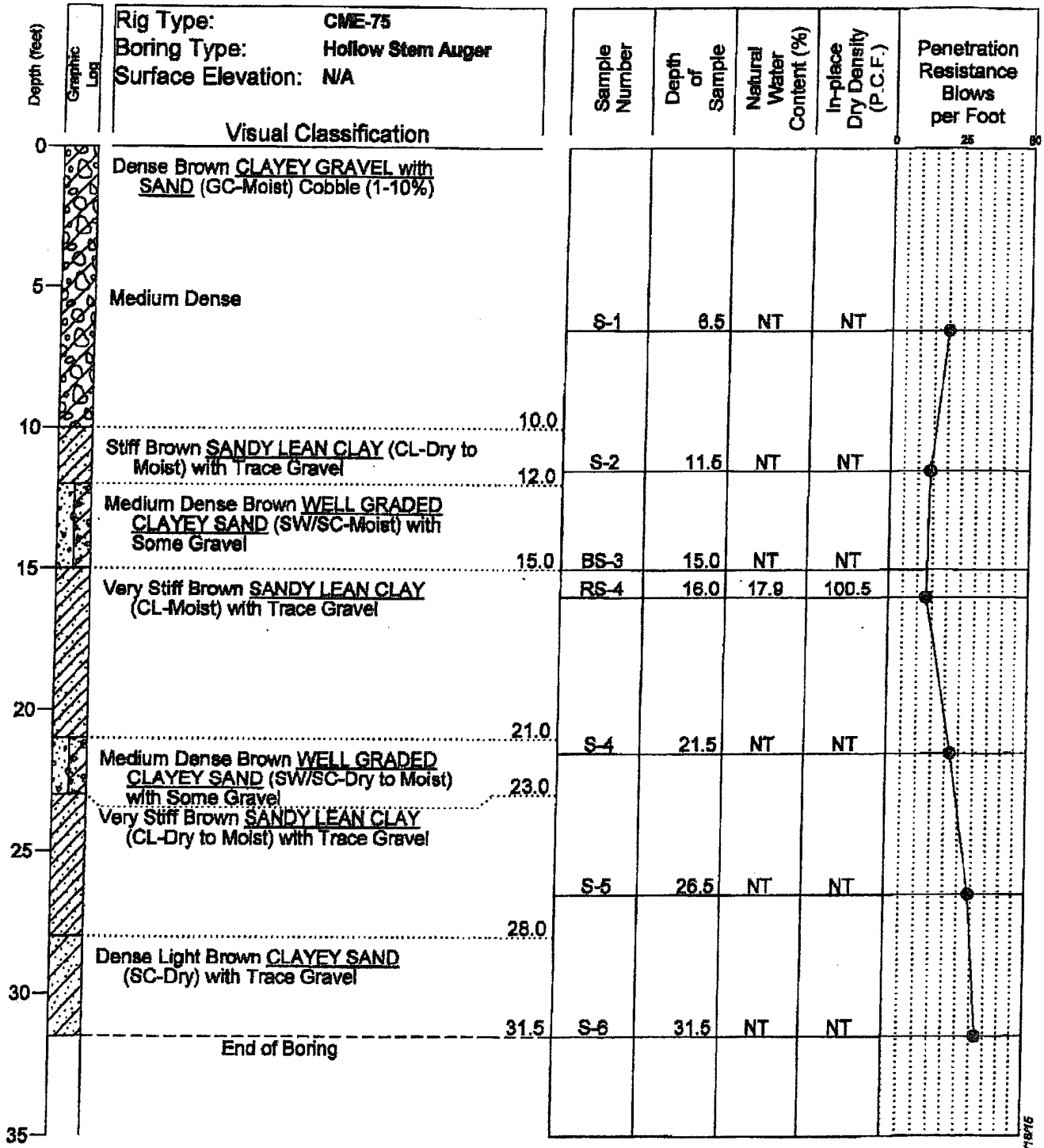
MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS (MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)			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 (LIQUID LIMIT GREATER THAN 50)			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" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

♦U.S. Standard ×Clear Square Openings





Boring Date: 9-29-15
Field Engineer/Technician: R. Markley
Driller: R. Quezada
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

Glendale City Hall Cooling Tower

5850 West Glendale Avenue

Glendale, Arizona

Project No.: 151538SA

_SPEEDIE 151538SA.GPJ GENGEO.GDT 10/19/15

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	BS-3	BULK	10.1 - 15.0	NT	NT	44	60	73	78	100	38	18	20	SC	CLAYEY SAND with GRAVEL
B-1	RS-4	RING	15.0 - 16.0	17.9	100.5	63	84	92	93	100	38	20	18	CL	SANDY LEAN CLAY

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

Glendale City Hall Cooling Tower
5850 West Glendale Avenue
Glendale, Arizona
Project No. 151538SA

SPEEDIE AND ASSOCIATES

TABULATION OF TEST DATA 151538SA.GPJ GRIGGS.GDT 10/9/15

CONSOLIDATION TEST

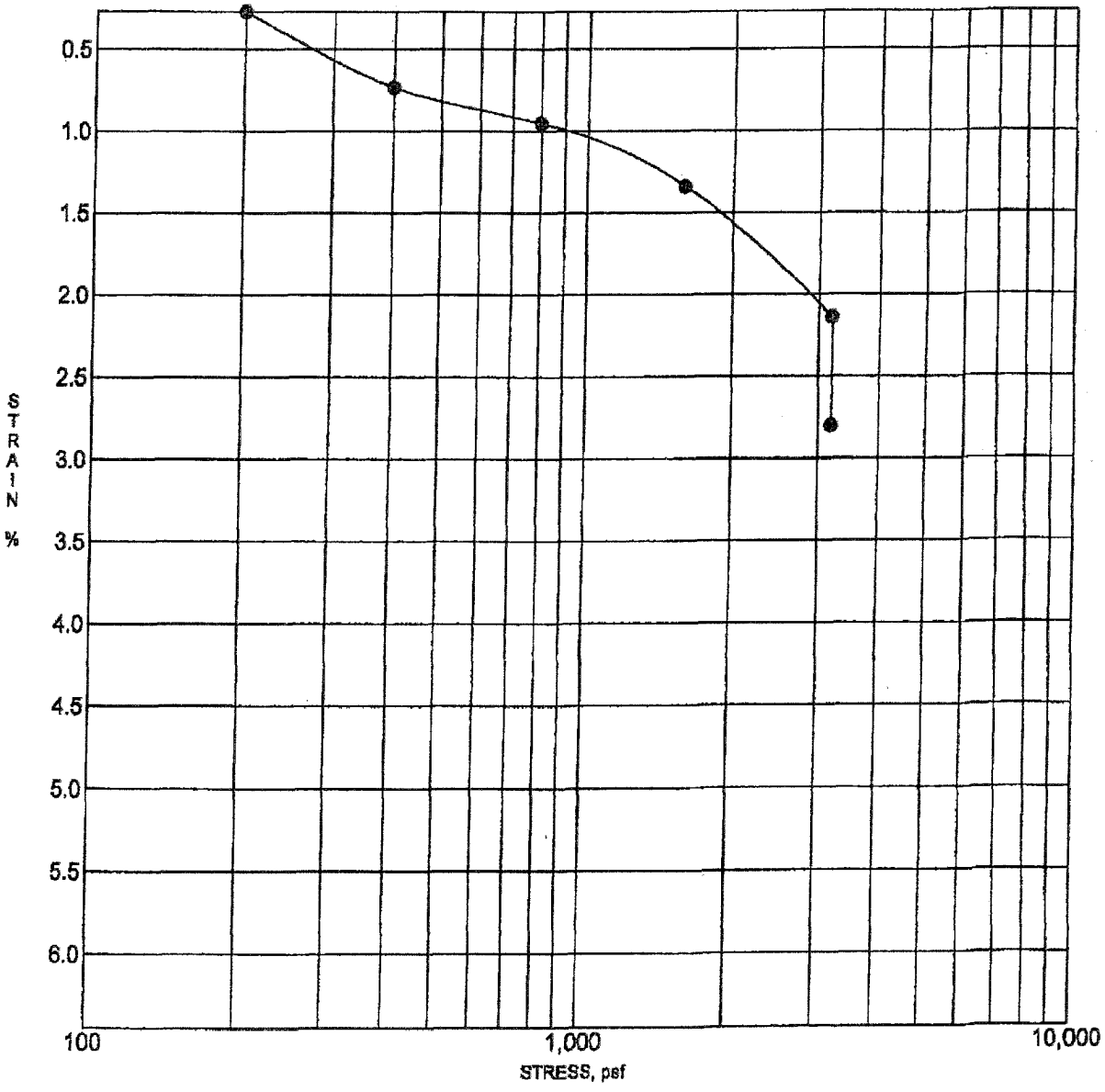
PROJECT: Glendale City Hall Cooling Tower — PROJECT NO.: 151538SA

LOCATION: 6850 West Glendale Avenue — DATE: 9/29/15

BORING NO.: B- 1 SAMPLE NO.: RS-4 SAMPLE DEPTH: 15 to 16 LABORATORY NO.:

LIQUID LIMIT: 38 PLASTIC LIMIT: 20 PLASTICITY INDEX: 18

CLASSIFICATION: CL ASTM SOIL DESCRIPTION: SANDY LEAN CLAY



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 151538SA.GPJ GENGEO.GDT 10/9/15

MOISTURE-DENSITY RELATIONS

PROJECT: Glendale City Hall Cooling Tower — PROJECT NO.: 151538SA

LOCATION: 5850 West Glendale Avenue — DATE: 9/29/15

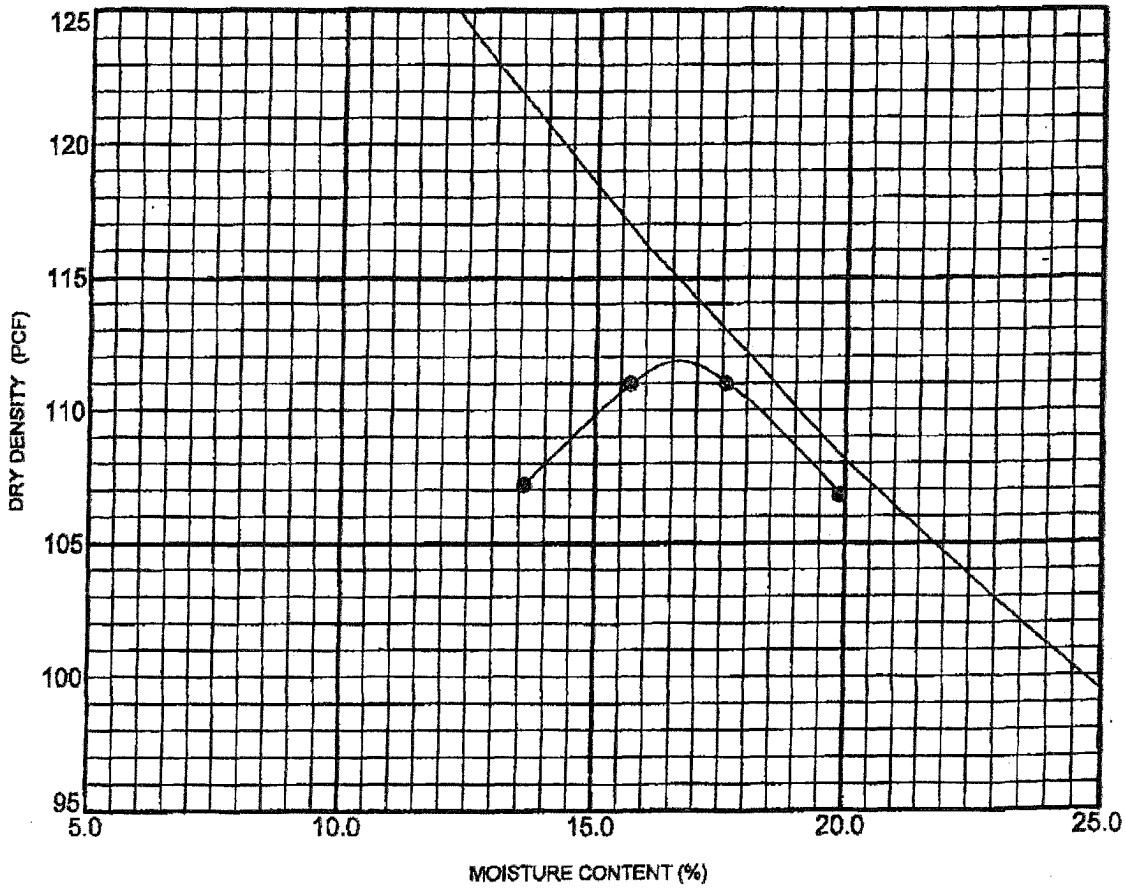
BORING NO.: B-1 SAMPLE NO.: BS-3 SAMPLE DEPTH: 10.1 to 15 — LABORATORY NO.:

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 38 PLASTIC LIMIT: 18 PLASTICITY INDEX: 20

CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND with GRAVEL

MAXIMUM DRY DENSITY: 111.9 PCF — OPTIMUM MOISTURE CONTENT: 16.6%



SPEEDIE AND ASSOCIATES

GEOTECH PROCTOR 151538SA.GPJ 10/6/15

SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B- 1, BS-3	15.0	111.9	16.6	106.7	14.3	95.3	20.8	100	2.6

Sheet 1 of 1

Glendale City Hall Cooling Tower
5850 West Glendale Avenue
Glendale, Arizona
Project No. 151538SA

SPEEDIE AND ASSOCIATES

SWELL TEST 151538SA.PRJ GENGEO.GDT 10/9/15

151535

Job No. 15-673 Sheet No. Cover
By DTN Date 10/15

CARUSO TURLEY SCOTT
structural engineers

Registered Professional Engineer (Structural)
CERTIFICATE NO.
42184
BRADY K. NOTBOHM
11-12-15
Date Signed
ARIZONA, U.S.A.
EXPIRES 03-31-17

CLIENT:
Pearson Engineering Associates Inc.
8825 N. 23rd Ave
Phoenix, AZ 85021

PROJECT:
City Hall Cooling Tower Replacement
5850 West Glendale Ave

STRUCTURAL ENGINEERING EXCELLENCE

PARTNERS
Richard Turley, PE
Paul Scott, PE, SE
Sandra Herd, PE, SE, LEED AP
Chris Atkinson, PE, SE, LEED AP
Thomas Morris, PE, LEED AP
Richard Dettmann, PE

GENERAL INFORMATION:

BUILDING CODE: 2012 IBC, ASCE 7-10

Scope:
- Add site wall supported on grade beams and drilled peirs
- Add 3-9000# max mechanical units supported on steel frame and drilled piers

Delta 1 - City Comments

1215 W. Rio Salado Pkwy.
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Tempe, AZ 85281
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CARUSO TURLEY SCOTT
consulting structural engineers

1215 W. Rio Salado Pkwy.
Suite 200
Tempe, AZ 85281
T: (480) 774-1700
F: (480) 774-1701

Job Name Murrieta Police Solar

Job No. 15-054 Sheet No. Index

By DTN Date 1/15

CALCULATION INDEX SHEET

SHEET #	DESCRIPTION
A	Basis For Design
1 – 2	Wind Analysis
3	Site Wall Design
4 - 15	Grade Beam And Drilled Pier Design
16	Site Wall Lintel Design
17 – 22	Steel Frame Design (Mechanical Unit Supports)

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Tempe, AZ 85281
T: (480) 774-1700
F: (480) 774-1701

Job Name Glendale cooling tower

Job No. 15-673 Sheet No. A

By DTN Date

BASIS FOR DESIGN

BUILDING CODE: 2012 EDITION OF THE INTERNATIONALBUILDING CODE
ASCE/SEI 7-10 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES

LOADS:

WIND:
3 SECOND WIND GUST = 115 MPH.
RISK CATEGORY = II.
EXPOSURE C.

FOUNDATIONS: GEOTECHNICAL REPORT BY SPEEDIE AND ASSOCIATES; JOB NO. 151538SA.CAISSON CONCRETE SHALL BE PLACED ON CLEAN INSPECTED BEARING A MINIMUM OF 15'-0" INTO BEARING STRATA. ASSUME TOP OF BEARING STRATA 2'-0" BELOW FINISHED FLOOR. EXACT BEARING ELEVATION SHALL BE FIELD VERIFIED BY SOILS ENGINEER AT THE TIME OF DRILLING. DESIGN SOIL BEARING VALUE = 90KIPS. REFER TO GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION PRIOR TO COMMENCEMENT OF EARTHWORK.

CONCRETE: MINIMUM 28 DAY STRENGTH:
FOUNDATIONS AND CAISSONS ---------- 2,500 PSI

REINFORCING: BARS #5 AND LARGER: Fy = 60,000 PSI.
BARS #4 AND SMALLER: Fy = 40,000 PSI.

STRUCTURAL STEEL: BEAMS AND COLUMNS: Fy = 50 KSI
PLATE STEEL: Fy = 36 KSI

WINDSPEED BY LOCATION

Applied Technology Council

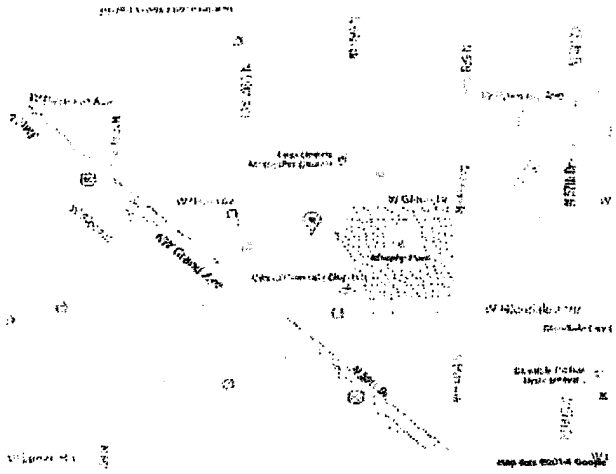
Search Results

Latitude: 33.5394
Longitude: -112.1854

ASCE 7-10 Wind Speeds (3-sec peak gust MPH*):

Risk Category I: 105
Risk Category II: 115
Risk Category III-IV: 120
MRI 10 Year:** 76
MRI 25 Year:** 84
MRI 50 Year:** 90
MRI 100 Year:** 96

ASCE 7-05: 90
ASCE 7-93: 72



*MPH(Miles per hour)
**MRI Mean Recurrence Interval (years)
Users should consult with local building officials to determine if there are community-specific wind speed requirements that govern.

WIND SPEED WEB SITE DISCLAIMER:
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CARUSO TURLEY SCOTT INC.
consulting structural engineers

1215 W. Rio Salado Pkwy
Suite 200
Tempe, Arizona 85281
480-774-1700

Job Name:

Job No: 15-673 Sheet No: 2

By: DTN Date: 10/15

Fence Wind Loading (Section 29.4, ASCE 7-10) - Exp C

Section 29.3.2

Velocity Pressure = $q_h = 0.00256\, K_z\, K_{zt}\, K_d\, V^2$ (Eqn 23.3-1)

3 -Sec Wind Gust =	V =	115			mph	
Exposure Coeff =	K_z =	0.85				(Section 29.3.1, h≤ 15 ft)
Topographic Factor =	K_{zt} =	1.0				(Section 26.8.2)
Directional Coeff =	K_d =	0.85				(Section 26.6)
	q_h =	24.5			psf	

Section 29.4.1

Wind Load = $F = q_h\, G\, C_f\, A$ (Eqn 29.4-1)

Gust Factor =	G =	0.85				(Section 26.9.1)
Force Coeff =	C_f =	1.3				(Fig 29.4-1, B/s = 10)
Wall Area =	A =	1.0			ft^2	
	Increase* =	1.1				(See below)
Wind Pressure =	P =	29.7			psf	(Basic Ultimate Load)
Wind Pressure =	F =	17.8			psf	(Basic ASD Load - 0.6W)

* Per Footnote 3, Fig 29.4-1, resultant force of wind pressure is to act at 0.05 times the average height of the wall.
To account for this, increase the wind load using equivalent moments.

$$\frac{w_e l^2}{2} = wl\left(l/2 + l(0.05)\right)$$

$$w_e = 0.55w(2) = 1.1w$$

Increase wind by 10%

Caruso Turley Scott, Inc
1215 W.Rio Salado Pkwy #200
Tempe, AZ 85301
480-774-1700
480-774-1701
www.ctsaz.com

Project Title:
Engineer:
Project Descr:

Project ID: 3

Printed: 26 OCT 2015, 10:13AM

Cantilevered Retaining Wall

File = G:_CDF16-1\15873C-1\CALCUL-1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.6
Lic. # : KW-06000624 Licensed : caruso turley scott

Description : Wall calc

Criteria

Retained Height	=	0.00 ft
Wall Height above soil	=	23.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water Height over Heel	=	0.0 ft

Vertical component of active Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	45.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure	=	389.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	17.8 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	0.38 UNSTABLE!
Sliding	=	4.11 OK
Total Bearing Load	=	3,559 lbs
...resultant ecc.	=	23.37 in

Resultant Exceeds Ftg. Width!

Soil Pressure @ Toe	=	0 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	0 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	1.4 psi OK
Allowable	=	75.0 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	430.2 lbs
less 100% Passive Force	= -	345.8 lbs
less 100% Friction Force	= -	1,426.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	22.50	0.00
Wall Material Above "Ht"	=	Masonry	Masonry
Thickness	in =	12.00	12.00
Rebar Size	=	# 6	# 6
Rebar Spacing	in =	8.00	16.00
Rebar Placed at	=	Edge	Edge
Design Data			
fb/FB + fa/Fa	=	0.000	0.863
Total Force @ Section	lbs =	8.9	409.4
Moment....Actual	ft-l =	2.2	4,708.1
Moment....Allowable	ft-l =	6,915.5	5,454.2
Shear.....Actual	psi =	0.1	3.8
Shear.....Allowable	psi =	38.7	38.7
Wall Weight	psf =	133.0	133.0
Rebar Depth 'd'	in =	9.00	9.00
Lap splice if above	in =	36.00	54.00
Lap splice if below	in =	36.00	10.41
Hook embed into footing	in =	36.00	10.41
Masonry Data			
f'm	psi =	1,500	1,500
Fs	psi =	24,000	25,600
Solid Grouting	=	Yes	Yes
			Yes
Modular Ratio 'n'	=	21.48	21.48
Short Term Factor	=	1.000	1.000
Equiv. Solid Thick.	in =	11.60	11.60
Masonry Block Type	=	3	
Masonry Design Method	=	ASD	

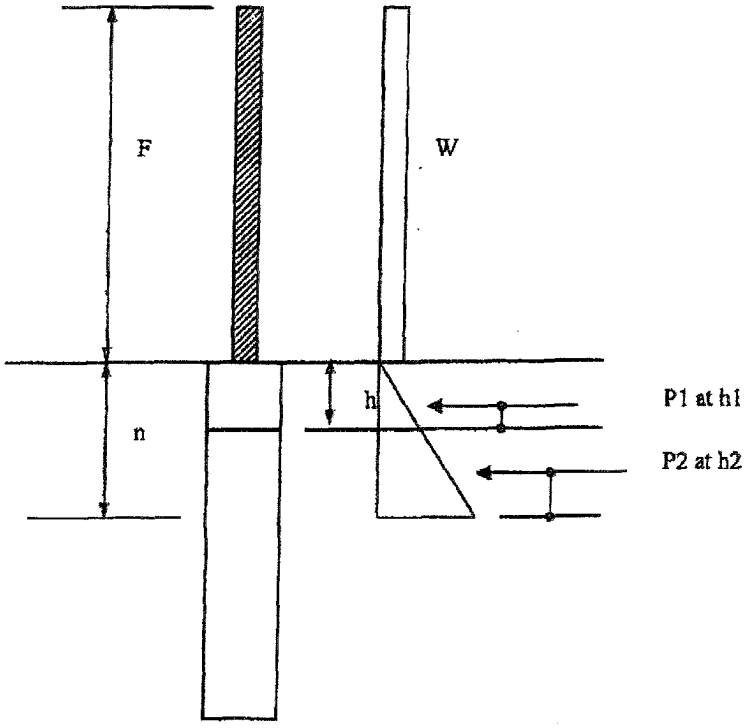
See grade beam Design

Grade Beam Torsional Strength with Ties - No Retaining, Neglect Soil

Grade Beam Depth	b =	24 in	No of Bar		4
Grade Beam Height	h =	30 in	Phi		0.85
Stirup Spacing	s =	10 in	Yield Strength		40000 psi
Steel Area of Stirrup	As =	0.20 in^2			

= user input required

Aoh =	411.25	*Aoh = (b-6-bar number/8)*(h-6-bar number/8)*
Ao =	349.56	*Ao = Phi*Aoh*
Tn =	39617.08	*Tn = 2*Phi*Ao*As*Fy/s*



Sketch of Pier and Grade Beam

Spacing and Moment Calculations for Wall

Wind	W =	29.7 psf	Pier Dia	D =	2 ft
Active	A =	40 pcf	Neglected Depth	n =	2 ft
Capacity	Tn =	39617 ft-lbs	Grade Beam Depth	h =	1 ft
Force P1 at	h1 =	0.333 ft	Soil Pier Load	P2 =	120 lbs
Force P2 at	h2 =	0.500			

Fence Height F (ft)	Torsion Force Tu (ft-lbs)	Required Pier Spacing Smax (ft)	Actual Spacing S (ft)	Wind Wall Load Wll (plf)	Soil Grade Beam Load P1 (lbs)	Soil Moment M (ft-lbs)	Total Soil P (lbs)	Total Soil Force at y (ft)
23.00	342.38	233.42	20		400.00	233.333		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		
0.00	0.83	95083.00	0		0.00	100.000		

= user input required = values into Enercalc

$$T_u = W * F * \frac{h}{2} + \frac{1}{6} * A * \left(\frac{h}{2}\right)^3 \qquad S_{max} = \frac{2T_n}{T_u} + D \qquad W_{ll} = W * S$$

$$P_1 = 0.5 * A * h^2 * S \qquad h_1 = \frac{h}{3} \qquad P_2 = 0.5 * A * D * (n^2 - h^2)$$

$$h_2 = \frac{n-h}{2} \qquad P_s = P_1 + P_2 \qquad M_s = P_1 * h_1 + P_2 * h_2 \qquad y = \frac{M_s}{P_s}$$

Wll is the distributed load on fence due to the wind. This must be applied from the top of the neglected height to the top of the fence.

P is the total soil load on the pier resulting from the soil load on the grade beam plus the soil load on the pier due to the neglected soil.

y is the height to the point of application for the total soil load.

The soil load and its location, along with the distributed load on the fence are placed into Enercalc to determine a pier depth. The pier depth starts at the bottom of the neglection. The neglection must be added to the calc'd pier depth for a total depth of the pier.

Pier Vertical Reinforcing

Pier / Caison Diameter [ft]	Point Load on Pier [lb]	Clear Cover for Pier [in]
2.00	8197	3.5

=user input required
=calc'd values

Maximum Moment on Pile Calculation = Ho * L *[(E / L + X / L) - (4 * E / L + 3) * (X / L)^3 + (3*E/L + 2) * (X / L)^4] = [ft-lb/ft] =

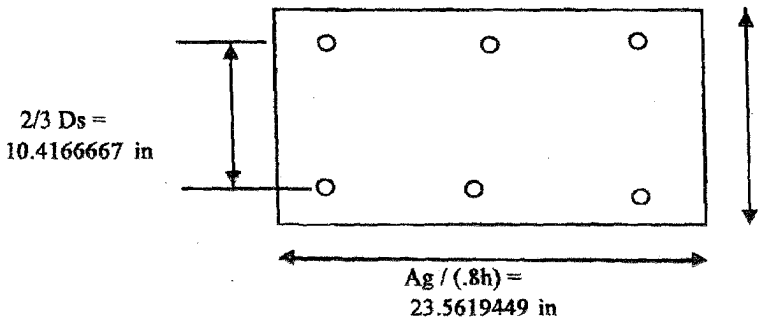
Ho = Lateral force per foot width of pole diameter, applied at the resisting surface, Pounds per foot of Diameter =
L = Required depth of pile, measured from the resisting surface [ft] = 14.625
E = Distance from Lateral Load to resisting surface, ft = 11.5
X = Distance along pile, measured from resisting surface = a/2 (max moment) =

Maximum Moment Occurs at a/2, a = (4 * E * L + 3 * L^2) / (6 * E + 4 * L) = ft

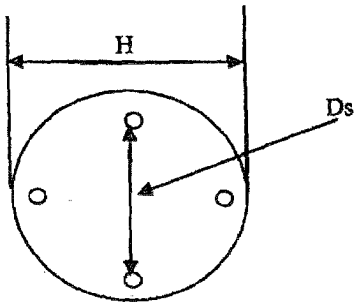
E / L = X / L =

Design Moment for Pile Mu = 1.3 * Pole Diameter * Max Moment on Pile = [ft - lb] =

Convert Circular Pier into Equivalent Rectangular Section:



.8H =
19.2 in



Ds = Diamter of Caisson - Cover * 2 - Stirrup - 1 db (assume 5/8") = 15.625 in

Deffective =.8H-cover= 15.7 in

Steel Required for Caisson

b [in]	deff [in]	f'_c [psi]	f_y [psi]	M_u [in-lbs]	Steel to be Used
[illegible]	[illegible]	2500	60000	[illegible]	6

ρ Required	ρ Min 200/f_y	ρ Min 3(f'_c)$^{.5}$/f_y	ρ min 4/3 req	ρ_{max}
0.00611719	0.00333333	0.0025	0.00815626	0.01336256

Use ρ	As req
0.003333	1.23295181

[illegible]

Beta		
0.85	< 4000	0.01336256
0.8	<5000	0.01257653
0.75	< 6000	0.0117905

Hairpin Connection

d [in]	α [-]	λ [-]	β [-]	d_b [in]	Tension Ft [psi]
[illegible]	1	1	1	[illegible]	[illegible]

d=Caisson Diameter (In) -Cover

$F_t = 0.9 * f_y$

Development Length, l_d = [illegible] in

Hook Development Length, l_{dh} = [illegible] in

Rebar Tension, T = [illegible] lbs

Required Hairpin Steel, A_{sr} = [illegible] in^2

$$T = \frac{M_u}{d}$$

$$A_{sr} = \frac{T}{F_t}$$

$$l_d = \frac{d_b * f_y * \alpha * \beta * \lambda}{25 * \sqrt{f'_c}}$$

$$l_{dh} = \frac{0.02 * \beta * \lambda * f_y * d_b}{\sqrt{f'_c}}$$

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Project Descr:

Project ID:

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Pole Footing Embedded in Soil

File = G:_CDF16-1\15673C-1\CALCUL-1\WALLCA-1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.6

Lic. # : KW-06000624 — Licensee : caruso turley scott

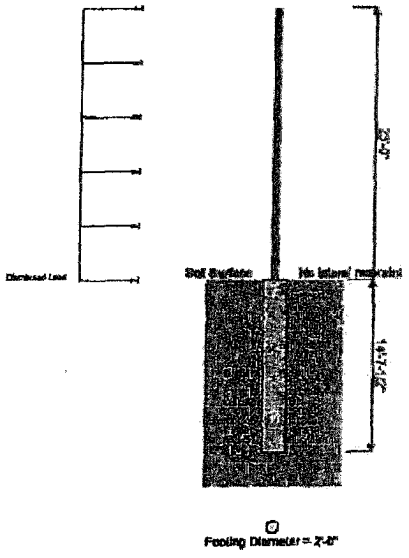
Description : drilled pier

Code References

Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-10

General Information

Pole Footing Shape	Circular
Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	250.0 pcf
Max Passive	1,500.0 psf



Controlling Values

Governing Load Combination : +D+0.60W+H

Lateral Load	8.197 k
Moment	94.268 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	1,218.12 psf
Allowable	1,218.56 psf
Minimum Required Depth	**14.625 ft**
Footing Base Area	3.142 ft^2
Maximum Soil Pressure	0.0 ksf

Applied Loads

	Lateral Concentrated Load		Lateral Distributed Load	Vertical Load
D : Dead Load	k	k/ft		k
Lr : Roof Live	k	k/ft		k
L : Live	k	k/ft		k
S : Snow	k	k/ft		k
W : Wind	k	k/ft	0.5940	k
E : Earthquake	k	k/ft		k
H : Lateral Earth	k	k/ft		k
Load distance above ground surface	ft	TOP of Load above ground surface	23.0 ft	
		BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface: Loads - (k)	Forces @ Ground Surface: Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth: Actual - (psf)	Pressure at 1/3 Depth: Allow - (psf)	Soil Increase Factor
+D+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+L+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+Lr+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+S+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750Lr+0.750L+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750L+0.750S+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W+H	8.197	94.268	14.63	1,218.1	1,218.6	1.000
+D+0.70E+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750Lr+0.750L+0.450W+H	6.148	70.701	13.13	1,084.0	1,085.2	1.000

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Project Title:
Engineer:
Project Descr:

Project ID: 10

Printed: 12 NOV 2015, 11:37AM

Concrete Beam

File = G:_CDF16-1\156873C-1\CALCUL-1\WALLCA-1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31

Lic. # : KW-D6000624 Licensee : caruso turley scott

Description : gravity

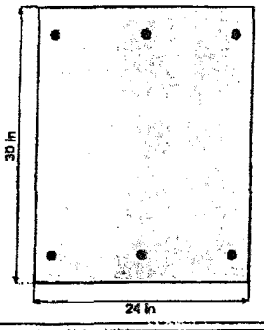
CODE REFERENCES

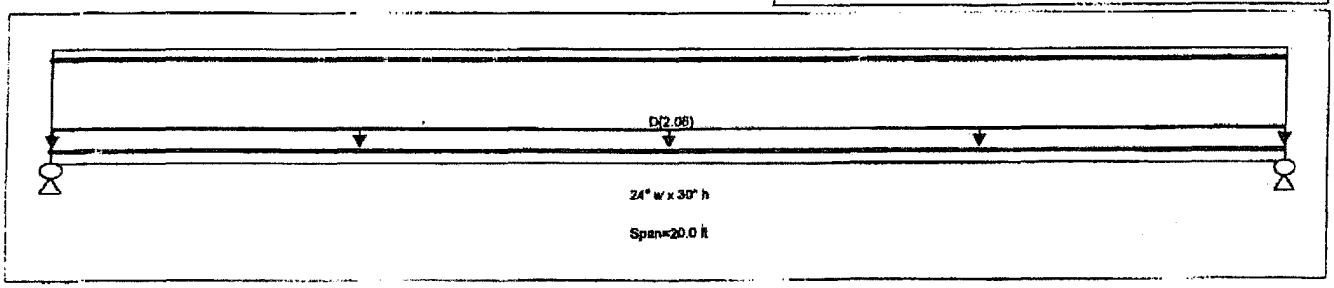
Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^12 * 7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	150.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	2,880.95 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	# 3
			Number of Resisting Legs Per Stirrup	=	1.0

Load Combination ASCE 7-10





Cross Section & Reinforcing Details

Rectangular Section, Width = 24.0 in, Height = 30.0 in
Span #1 Reinforcing...
3-#8 at 3.0 in from Bottom, from 0.0 to 20.0 ft in this span
3-#8 at 3.0 in from Top, from 0.0 to 20.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 2.060 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.721 : 1	Maximum Deflection			
Section used for this span	Typical Section	Max Downward Transient Deflection	0.000 in	Ratio =	0 <360
Mu : Applied	196.699 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Mn * Phi : Allowable	272.930 k-ft	Max Downward Total Deflection	0.096 in	Ratio =	2508
Load Combination	+1.40D+1.60H	Max Upward Total Deflection	0.000 in	Ratio =	999 <180
Location of maximum on span	10.018 ft				
Span # where maximum occurs	Span # 1				

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	28.100	28.100
Overall MINimum	16.860	16.860
+D+H	28.100	28.100
+D+L+H	28.100	28.100
+D+Lr+H	28.100	28.100
+D+S+H	28.100	28.100
+D+0.750Lr+0.750L+H	28.100	28.100
+D+0.750L+0.750S+H	28.100	28.100
+D+0.60W+H	28.100	28.100
+D+0.70E+H	28.100	28.100
+D+0.750Lr+0.750L+0.450W+H	28.100	28.100
+D+0.750L+0.750S+0.450W+H	28.100	28.100
+D+0.750L+0.750S+0.5250E+H	28.100	28.100
+0.60D+0.60W+0.60H	16.860	16.860

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Project Title:
Engineer:
Project Descr:

Project ID:

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Concrete Beam

File = G:_CDF16~1\115673C~1\CALCS~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.8, Ver:6.15.10.31
Lic. # : KW-06000624 Licensee : carusoturley scott

Description : gravity

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.600+0.70E+0.60H	16.860	16.860
D Only	28.100	28.100
Lr Only		
L Only		
S Only		
W Only		
E Only		
H Only		

Shear Stirrup Requirements

Between 0.00 to 3.86 ft, PhiVc/2 < Vu <= PhiVc, Req'd Vs = Min 11.5.6.3, use stirrups spaced at 3.000 in
Between 3.90 to 16.10 ft, Vu < PhiVc/2, Req'd Vs = Not Reqd 11.4.6.1, use stirrups spaced at 0.000 in
Between 16.14 to 19.96 ft, PhiVc/2 < Vu <= PhiVc, Req'd Vs = Min 11.5.6.3, use stirrups spaced at 3.000 in

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.0957	10.000		0.0000	0.000

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Project Descr:

Project ID: 7L

Printed: 12 NOV 2015, 11:38AM

Concrete Beam

File = C:\...CDF16~1\156730~1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31
Lic. # : KW-06000624
Licensee : caruso turley scott

Description : lateral

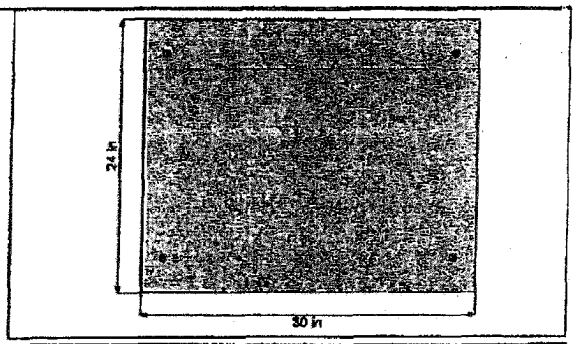
CODE REFERENCES

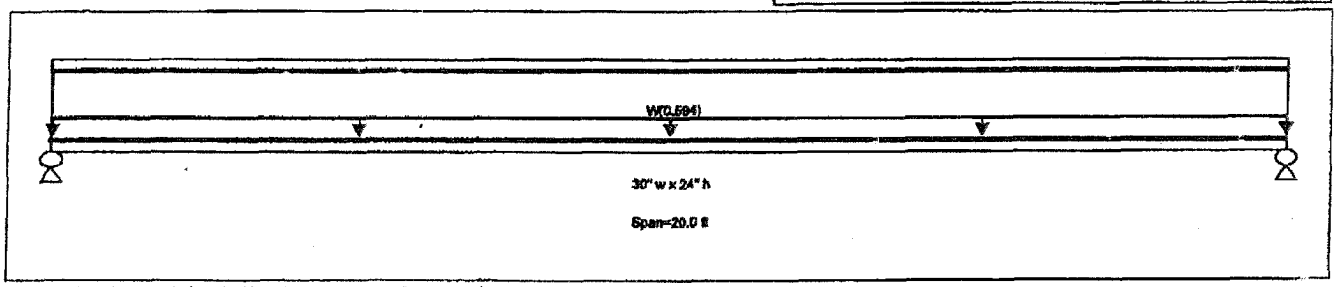
Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	2,880.96 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	# 3
			Number of Resisting Legs Per Stirrup	=	2

Load Combination ASCE 7-10





Cross Section & Reinforcing Details

Rectangular Section, Width = 30.0 in, Height = 24.0 in
Span #1 Reinforcing...
2-#5 at 3.0 in from Bottom, from 0.0 to 20.0 ft in this span

using 1 #8 bar
2-#5 at 3.0 in from Top, from 0.0 to 20.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
Uniform Load : W = 0.5940 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.466 : 1	Maximum Deflection	
Section used for this span	Typical Section	Max Downward Transient Deflection	0.021 in Ratio = 11178
Mu : Applied	29.70 k-ft	Max Upward Transient Deflection	0.000 in Ratio = 0 <360
Mn * Phi : Allowable	63.704 k-ft	Max Downward Total Deflection	0.013 in Ratio = 18630
Load Combination	+1.20D+0.50Lr+0.50L+W+1.60H	Max Upward Total Deflection	0.000 in Ratio = 999 <180
Location of maximum on span	9.982ft		
Span # where maximum occurs	Span # 1		

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	5.940	5.940
Overall MINimum	2.673	2.673
+D+H		
+D+L+H		
+D+Lr+H		
+D+S+H		
+D+0.750Lr+0.750L+H		
+D+0.750L+0.750S+H		
+D+0.60W+H	3.564	3.564
+D+0.70E+H		
+D+0.750Lr+0.750L+0.450W+H	2.673	2.673
+D+0.750L+0.750S+0.450W+H	2.673	2.673
+D+0.750L+0.750S+0.5250E+H		
+0.60D+0.60W+0.60H	3.564	3.564
+0.60D+0.70E+0.60H		

Area steel 2 #5 = .62 in²
Area steel 1 #8 = .79 in²
OK

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Project Title:
Engineer:
Project Descr:

Project ID: 13

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Concrete Beam

File = G:_CDF16--1\15673C-1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31
Lic. # : KW-06000624 Licensee : caruso turley scott

Description : lateral

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
D Only		
Lr Only		
L Only		
S Only		
W Only	5.940	5.940
E Only		
H Only		

Shear Stirrup Requirements

Entire Beam Span Length : Vu < PhiVc/2, Req'd Vs = Not Reqd 11.4.6.1, use stirrups spaced at 0.000 in

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.0215	10.000		0.0000	0.000

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Job Name _____

Job No. _____ Sheet No. 19

By _____ Date _____

Shear strength at Grade beam

$\phi V_c = 2\phi b_w d\sqrt{f_c'} = 2 \cdot .75 \cdot 24" \cdot (30" - 3" - .5") \sqrt{2500}$

$\phi V_c = 47.7\ K$

$\phi V_c/2 = 23.8\ K$

Shear force

$V_u = [(20' \cdot 20'/2 \cdot 103) + (2 \cdot 2.5 \cdot 150 \cdot 20'/2)] \cdot 1.2 = 33.72\ K$

$V_u > \phi V_c/2$ Shear reinforcing required

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Job Name _____

Job No. _____ Sheet No. 15

By _____ Date _____

Torsion Reinforcement

$A_{OH} = (24'-6" - .5)(30 - 6 - .5) = 411 \text{ in}^2$

Area of Stirrup

$\frac{A}{s} = Tu / 1.7 \phi A_{OH} f_y$

$A/s = 298 \text{ ft-lbs} / 1.7 \cdot .75 \cdot 411 \cdot 40 = .019 \text{ in}^2/\text{in} / \text{Arm}$

$.168 \text{ in}^2/\text{ft}/\text{Arm}$

Min Area

$\frac{Av + 2At}{s} = \frac{50 bw}{Fyt} = \frac{50(24)(12"/ft)}{60\,000} = .24"^2/ft$

Perimeter of Stirrup

$Ph = 2(24 - 3 - 3 - .5) + 2(30 - 3 - 3 - .5) = 83 \text{ in}$

Maximum Stirrup Spacing

$S_{max} = Ph/8 = 83 \text{ in}/8 = 10.375 \Rightarrow 10" oc$

Area provided

$A/s = .2(2)/1' = .4 \text{ in}^2 \geq .24"^2$ ok Use #4C 10' OC

Longitudinal Reinforcing

$Ac = \frac{AE}{s} ph \left(\frac{Fyt}{Fy}\right) = .168 \frac{(83")}{12"/ft}\left(\frac{60 \text{ ksi}}{60 \text{ ksi}}\right) = 1.162 \text{ in}^2$

$1.162 / .44 = 2.64 \approx 3$ Use 3 #6 long min

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Project Title:
Engineer:
Project Descr:

Project ID: 16

Printed: 26 OCT 2015, 10:32AM

Masonry Beam

File = G:_CDF16-1115673C-1\CALCULA~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.6
Lic. # : KW-06000624 Licensee : caruso turley scott

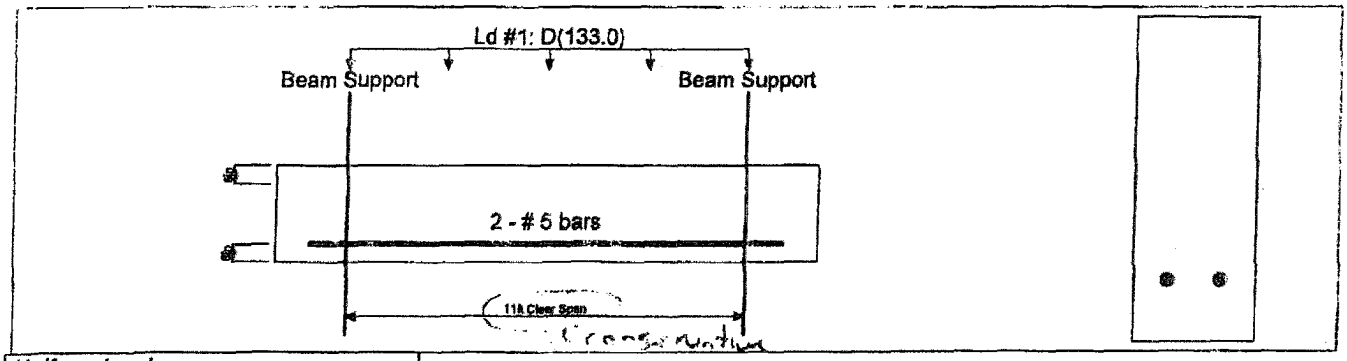
Description : lintel

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-10

General Information

f'm	1,500.0 psi		Clear Span	11.0 ft	Rebar Size	5.0
Fs	24,000.0 psi		Beam Depth	2.667 ft	# Bars E/F	2
Em = f'm *	750.0		Thickness	12 in	Top Clear	6.0 in
Wall Wt Mult	1.0		End Fixity	Pin-Pin	Btm Clear	6.0 in
Block Type	Normal Wt		Equiv. Solid Thick	11.60 in	# Bar Sets	1
Lateral Wind Load	17.80 psf		Wall Weight	133.0 psf	Bar Spacing	5.0 in
Lateral Wall Weight Seismic Factor		0.330	E	1,125.0 ksi		
Calculate vertical beam weight ?		Yes	n	25.778		



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	11.0 ft	1.596					k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...	Vertical	Lateral	Combined
fb/Fb	0.5211	0.1331	**0.5378** : 1.00
fv/Fv	0.8146	0.04374	**0.8157** : 1.00

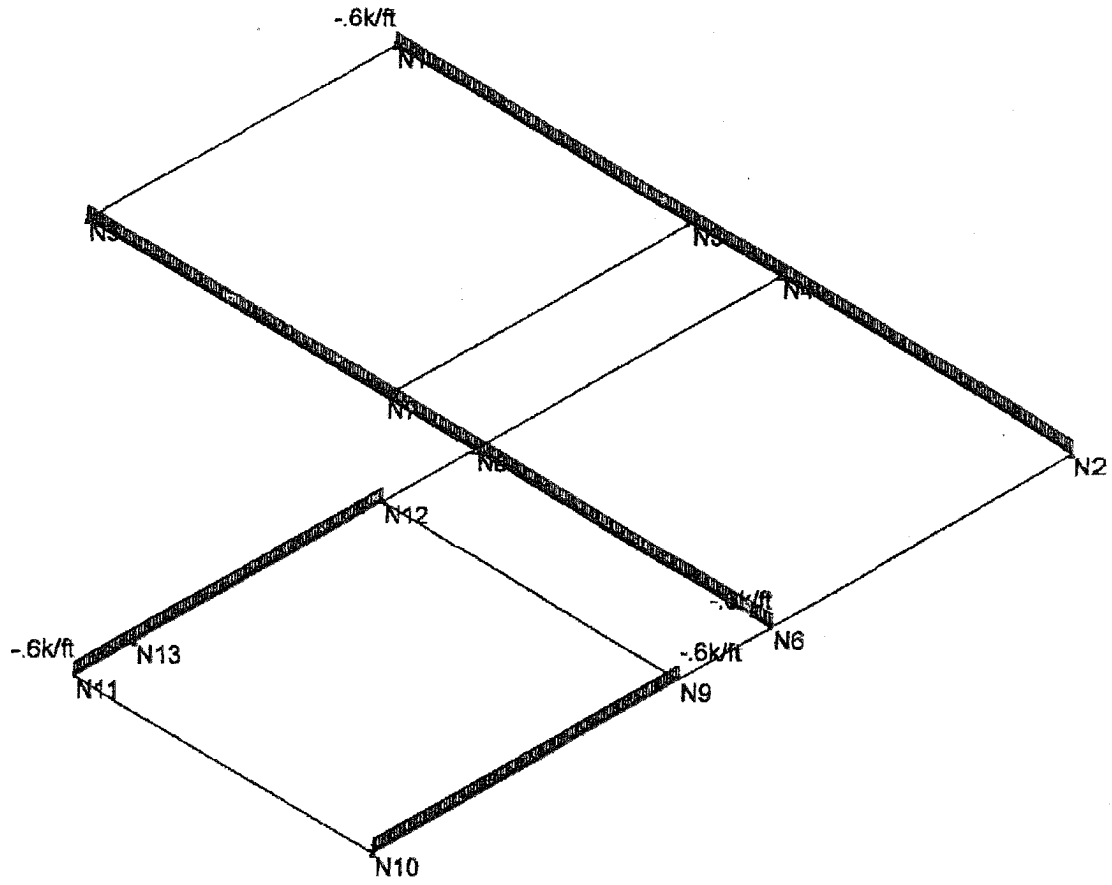
OK

Maximum Moment	Actual	Allowable
Vertical Loads for Load Combination : +D+H	29.504 k-ft	56.619 k-ft
Lateral Loads for Load Combination : +D+0.70E+H	1.239 k-ft	9.305

Maximum Shear	Actual	Allowable
Vertical Loads for Load Combination : +D+H	35.491 psi	43.571 psi
Lateral Loads for Load Combination : +D+0.70E+H	1.694 psi	38.730 psi

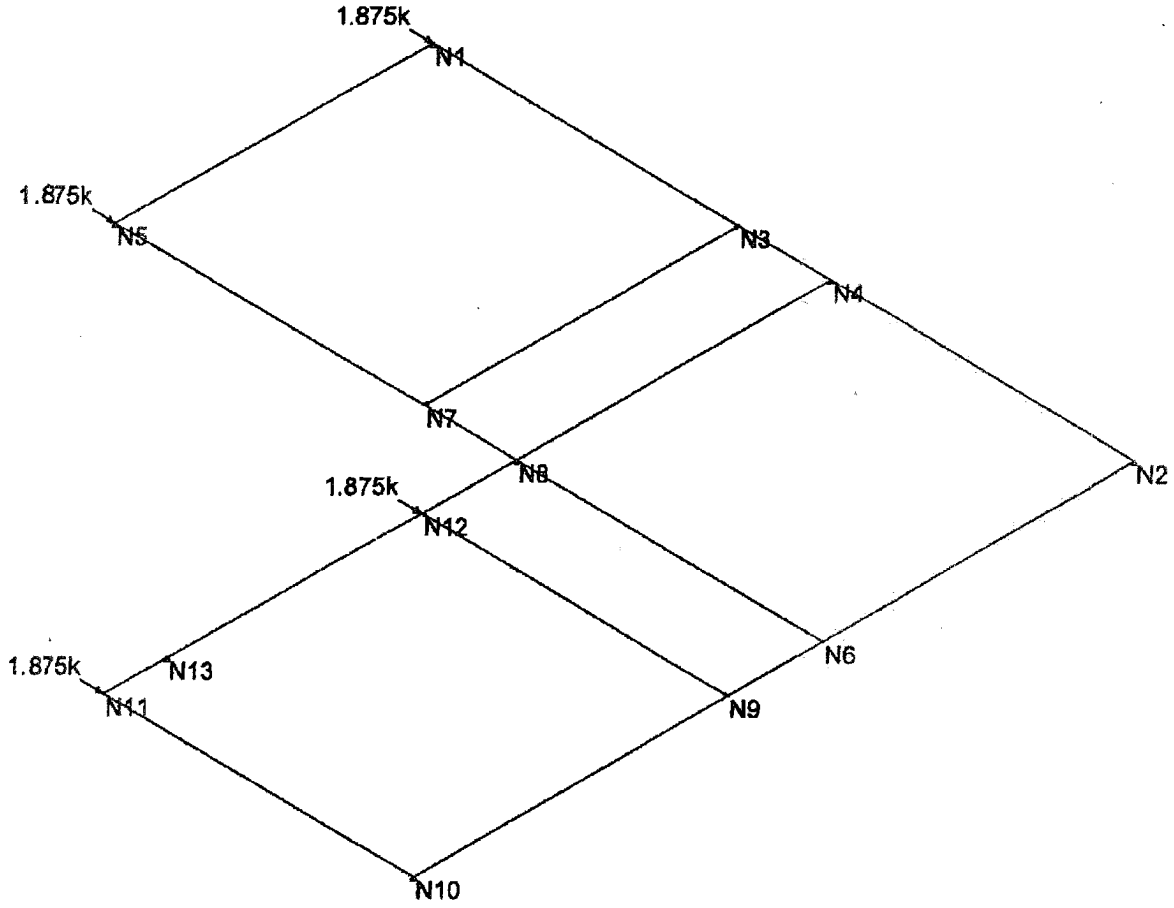
Minimum Mn = 1.3 * Fcr * S = 21.499 k-ft

Vertical Strength		Lateral Strength (Checking lateral bending for span)	
As	1.240 in^2	As	0.620 in^2
rho	0.004102	rho	0.002331
np	0.1057	np	0.06008
k : ((np)^2+2np)^.5-np	0.3661	k : (np^2+2np)^.5-np	0.2917
j = 1 - k/3	0.8780	j = 1 - k/3	0.9028
M:mas=Fb k j b d^2/2	71.068 k-ft	M:mas=Fb k j b d^2/2	16.379 k-ft
M:Stl = Fs As j d	56.619 k-ft	M:Stl = Fs As j d	9.305 k-ft



Loads: BLC 2, Dead - mech
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 1
BKN		Oct 26, 2015 at 10:51 AM
14-1298		14-1298 - City of Glendale_Cooling...



Loads: BLC 3, Wind - X
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 2
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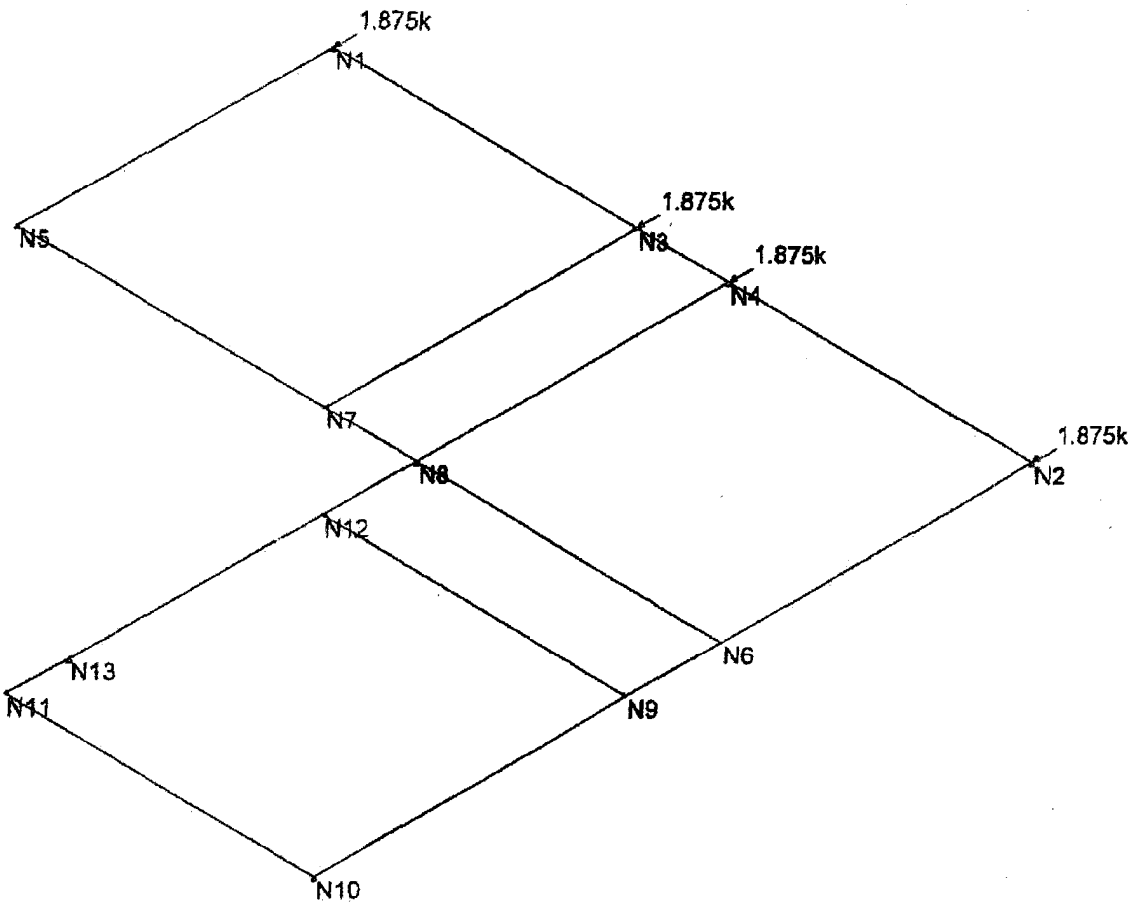


Loads: BLC 4, Wind - Z
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 3
BKN		Oct 26, 2015 at 10:45 AM
14-1298		14-1298 - City of Glendale_Cooling..

Envelope AISC 14th(360-10): ASD Steel Code Checks

	Member	Shape	Code Check	Lo...	LC	She...	Lo...	...	...	Pnc/om [k]	Pnt/o...	Mnyy/...	Mnzz/...	Cb	Eqn
1	MEMBER 1	W12x40	.089	12...	6	.073	12...	y	3	87.016	350.2...	41.916	142.2...	1.8...	H1-1b
2	MEMBER 4	W12x40	.254	11...	3	.079	23	y	2	87.016	350.2...	41.916	97.421	1.2	H1-1b
3	M3	W12x40	.028	0	2	.015	5	z	2	264.926	350.2...	41.916	142.2...	1.1...	H1-1b
4	MEMBER 3	W12x40	.050	7.6...	3	.044	2.1...	y	3	87.016	350.2...	41.916	142.2...	1.9...	H1-1b
5	MEMBER 2	W12x40	.194	10...	6	.090	10...	y	2	87.016	350.2...	41.916	142.2...	1.9...	H1-1b
6	M6	W12x40	.010	0	6	.003	17...	y	2	264.926	350.2...	41.916	142.2...	1.1	H1-1b
7	M7	W12x40	.004	5	3	.004	10	y	2	264.926	350.2...	41.916	142.2...	1.1...	H1-1b
8	M8	W12x40	.004	5	2	.004	10	y	3	264.926	350.2...	41.916	142.2...	1.1...	H1-1b

OK

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1
3	A992	29000	11154	.3	.65	.49	50	1.1	65	1.1
4	A500 Gr.42	29000	11154	.3	.65	.49	42	1.4	58	1.3
5	A500 Gr.46	29000	11154	.3	.65	.49	46	1.4	58	1.3

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Ru...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Column	HSS8x8x6	Column	SquareTube	A500 Gr.46	Typical	10.4	100	100	160
2	Beam	W12x40	Beam	Wide Flange	A992	Typical	11.7	44.1	307	906
3	Brace	L4x4x4	Column	Single Angle	A36 Gr.36	Typical	1.93	3	3	.044

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	MEMBER 1	N1	N2			Beam	Beam	Wide Flange	A992	Typical
2	MEMBER 4	N2	N10			Beam	Beam	Wide Flange	A992	Typical
3	M3	N10	N11			Beam	Beam	Wide Flange	A992	Typical
4	MEMBER 3	N11	N4			Beam	Beam	Wide Flange	A992	Typical
5	MEMBER 2	N6	N5			Beam	Beam	Wide Flange	A992	Typical
6	M6	N5	N1			Beam	Beam	Wide Flange	A992	Typical
7	M7	N7	N3			Beam	Beam	Wide Flange	A992	Typical
8	M8	N12	N9			Beam	Beam	Wide Flange	A992	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	23	0	0	0	
3	N3	10	0	0	0	
4	N4	13	0	0	0	
5	N5	0	0	10	0	
6	N6	23	0	10	0	
7	N7	10	0	10	0	
8	N8	13	0	10	0	
9	N9	23	0	13	0	
10	N10	23	0	23	0	
11	N11	13	0	23	0	
12	N12	13	0	13	0	
13	N13	13	0	21	0	

Member Distributed Loads (BLC 2 : Dead - mech)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	MEMBER 1	Y	-.6	-.6	0	0
2	MEMBER 2	Y	-.6	-.6	0	0
3	MEMBER 3	Y	-.6	-.6	0	10
4	MEMBER 4	Y	-.6	-.6	13	233

9k·1.2 = 10.8k/2 10.8k/2 = 5.4k
5.4k/9' = .6k

Joint Loads and Enforced Displacements (BLC 3 : Wind - X)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N1	L	X	1.875
2	N5	L	X	1.875
3	N12	L	X	1.875
4	N11	L	X	1.875

Joint Loads and Enforced Displacements (BLC 4 : Wind - Z)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N1	L	Z	1.875
2	N3	L	Z	1.875
3	N4	L	Z	1.875
4	N2	L	Z	1.875

29.7·(14'·9'/2) = 1,875

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Me...	Surface(P...
1	Dead	DL		-1						
2	Dead - mech	DL						4		
3	Wind - X	WLX				4				
4	Wind - Z	WLZ				4				

Load Combinations

	Description	So...	P...	S...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	DL	Yes	Y		1	1	2	1																
2	DL+.6WLX	Yes	Y		1	1	2	1	3	.6														
3	DL-.6WLX	Yes	Y		1	1	2	1	3	-.6														
4	.6DL+.6WLX	Yes	Y		1	.6	2	.6	3	.6														
5	.6DL-.6WLX	Yes	Y		1	.6	2	.6	3	-.6														
6	DL+.6WLZ	Yes	Y		1	.6	2	1	4	.6														
7	DL-.6WLZ	Yes	Y		1	.6	2	1	4	-.6														
8	.6DL+.6WLZ	Yes	Y		1	.6	2	.6	4	.6														
9	.6DL-.6WLZ	Yes	Y		1	.6	2	.6	4	-.6														

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N5	max	1.118	3	2.407	3	.086	7	0	1	0	1	0	1
2		min	-1.118	2	1.444	8	-.086	6	0	1	0	1	0	1
3	N1	max	1.132	3	3.559	3	1.209	7	0	1	0	1	0	1
4		min	-1.132	2	2.136	9	-1.209	6	0	1	0	1	0	1
5	N8	max	.985	3	15.032	2	.557	7	0	1	0	1	0	1
6		min	-.985	2	9.019	8	-.557	6	0	1	0	1	0	1
7	N2	max	.03	2	4.288	3	1.067	7	0	1	0	1	0	1
8		min	-.03	3	2.573	4	-1.067	6	0	1	0	1	0	1
9	N10	max	.978	3	5.731	2	.014	2	0	1	0	1	0	1

Envelope Joint Reactions (Continued)

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
10		min	-.978	2	3.438	5	-.014	3	0	1	0	1	0	1
11	N4	max	.084	6	9.251	2	1.598	7	0	1	0	1	0	1
12		min	-.084	7	5.55	9	-1.598	6	0	1	0	1	0	1
13	N13	max	.356	3	4.588	3	.019	2	0	1	0	1	0	1
14		min	-.356	2	2.752	4	-.019	3	0	1	0	1	0	1
15	Totals:	max	4.5	3	44.855	2	4.5	7						
16		min	-4.5	2	26.913	4	-4.5	6						

Foundation depth to match drilled piers for site wall 15'-0" min

ADDENDUM

EXPIRES: 12/31/2016

PROJECT: CITY HALL COOLING TOWER REPLACEMENT

OWNER: CITY OF GLENDALE

ADDENDUM NO: 001

ADDENDUM DATE: January 8, 2016

PROJECT NO: AWA 2015.007.01

TO: City of Glendale – Engineering Department
5850 West Glendale Avenue
Glendale, Arizona 85301
Attn: Michael Johnson

FROM: Arrington Watkins Architects
5240 North 16th Street Suite 101
Phoenix, Arizona 85016
Deirdre Rowles, Project Manager
Tele: (602) 279-4373 Fax: (602) 279-9110

NOTICE TO BIDDERS The following list represents changes to the Contract Documents that will affect the bidding. All revisions are clouded and identified as Delta 2 dated January 8, 2016. Make corrections as identified:

DRAWING REVISIONS:

1. **Sheet A4 – Reissued**
   a. **Add** – General note F. "Clean and prep existing concrete deck surface in area of work to receive new penetrating colloidal concrete treatment shown dotted."
   b. **Add** –a penetrating colloidal concrete treatment system for a section of the existing concrete deck to the scope of work. Spray-Lock SCP 578 or an approved equal. www.spraylockcp.com

2. **Sheet A5A - Reissued**
   a. **Add** – Sprayed on cementitious fireproofing removal and repair to the scope of work for a two foot section of deck support beam in the basement mechanical room.
   b. **Add** – Expansion joint removal and compressible expansion joint replacement at level 1 between the parking garage structure and the existing tunnel.

3. **Sheet A5B - Reissued**
   a. **Add** – General note E. "Clean and prep existing concrete deck surface in area of work to receive new penetrating colloidal concrete treatment."
   b. **Add** – Keynote 10. "Remove existing sealant (caulk) and pre molded filler at the concrete deck expansion joint locations in the area of demolition. Clean and prep

joints and concrete surface to receive new expansion joint infill system and concrete deck surface treatment. Verify exact locations in the field."

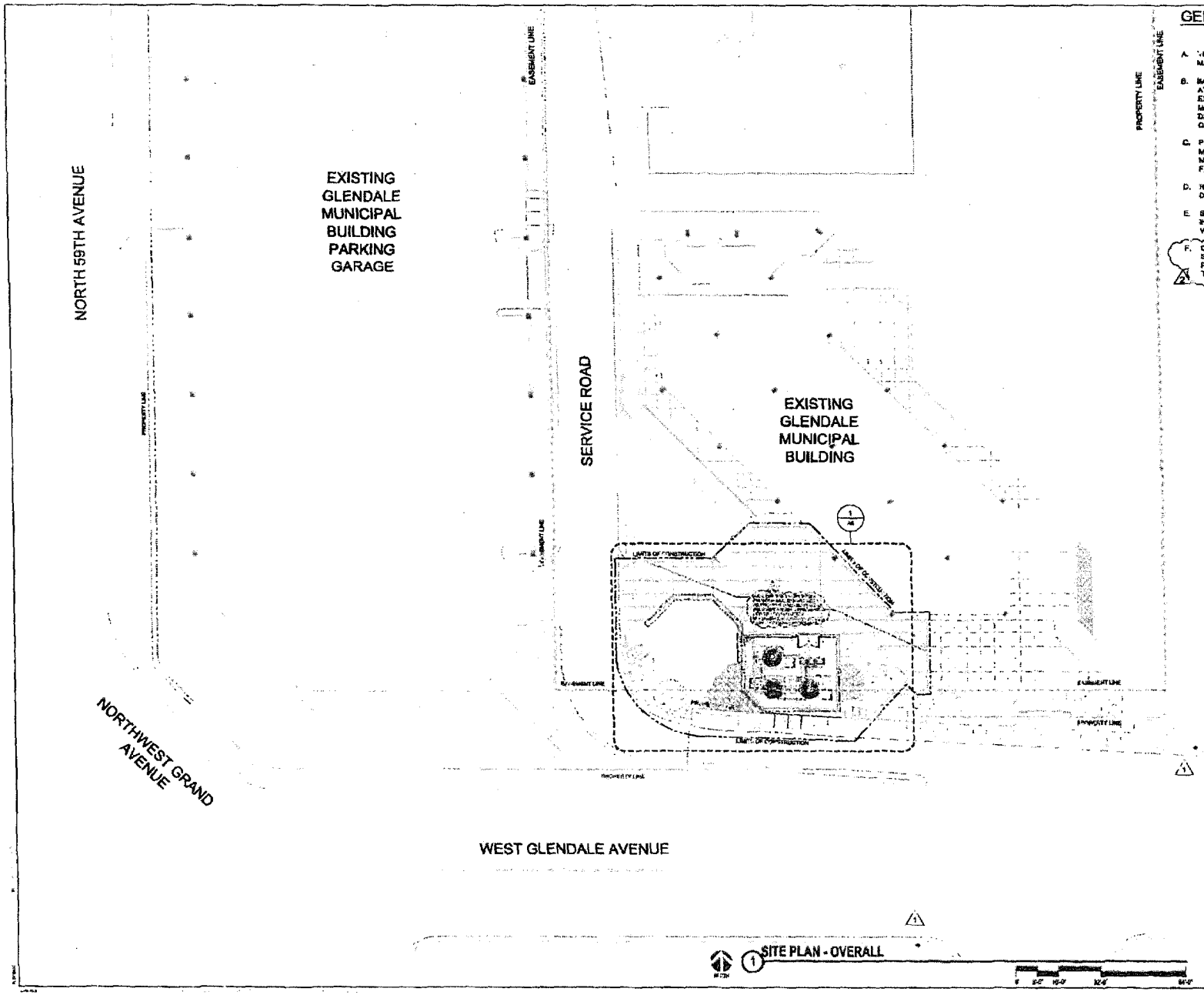
4. **Sheet A6 - Reissued**
    a. **Add** – A penetrating colloidal concrete treatment system for a section of the existing concrete deck to the scope of work. Spray-Lock SCP 578 or an approved equal. www.spraylockcp.com. The existing expansion joints are located on the drawings per the original record set. Verify joint locations in the field.
    b. **Add** – Deck expansion joint repair details are keyed in per the plan.

5. **Sheet A12 - Reissued**
    a. **Revise** - Details 7 and 10 to include the existing deck expansion joint repair system and the penetrating colloidal concrete treatment system for the deck surface.
    b. **Add** – Detail 8, Deck Expansion Joint Repair, to the construction documents.

ATTACHMENTS:

- A4 SITE PLAN – OVERALL
- A5A PARTIAL BASEMENT PLAN - DEMOLITION AND NEW WORK
- A5B SITE PLAN – DEMOLITION
- A6 SITE PLAN – ENLARGED FLOOR PLAN – NEW WORK
- A12 DETAILS

END OF ADDENDUM



GENERAL NOTES

A. VERIFY ALL CONDITIONS, DIMENSIONS AND MATERIALS IN THE FIELD.

B. IMMEDIATELY UPON DISCOVERY, BRING TO THE ATTENTION OF THE FIELD ARCHITECT ANY EXISTING MATERIALS OR STRUCTURAL MEMBERS WHICH ARE UNSTABLE, DETERIORATED OR OTHERWISE DAMAGED AND QUESTIONABLE FOR REUSE.

C. PROTECT ALL EXISTING FINISHES AND MATERIALS WHICH ARE TO REMAIN AS FINISHED MATERIALS OR AS A SUBSTRATE FOR A NEW FINISH MATERIAL.

D. REMOVE IMMEDIATELY FROM THE SITE ALL DEMOLISHED MATERIALS.

E. SEE CONSULTANT DRAWINGS FOR ADDITIONAL INFORMATION RELATED TO THE SCOPE OF WORK FOR THIS PROJECT.

F. CLEAN AND PREP EXISTING CONCRETE DECK SURFACE IN AREA OF WORK TO RECEIVE NEW PENETRATING COLLOIDAL CONCRETE TREATMENT SHOWN DOTTED.

1 SITE PLAN - OVERALL

SCALE: 1" = 32'-0"

CITY OF GLENDALE
ENGINEERING DEPARTMENT
5850 W. GLENDALE AVE.
GLENDALE, ARIZONA 85301 (623) 930-3630

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City Hall Cooling Tower Replacement
5850 West Glendale Avenue

602.263.1100

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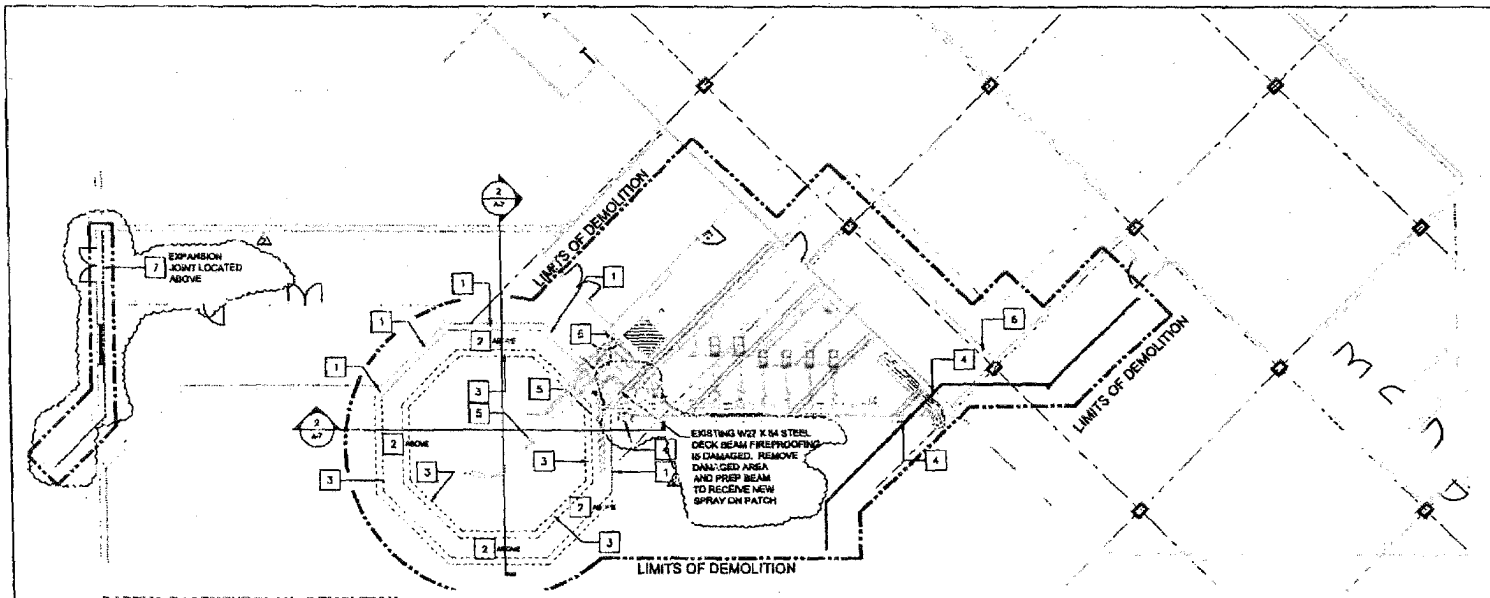
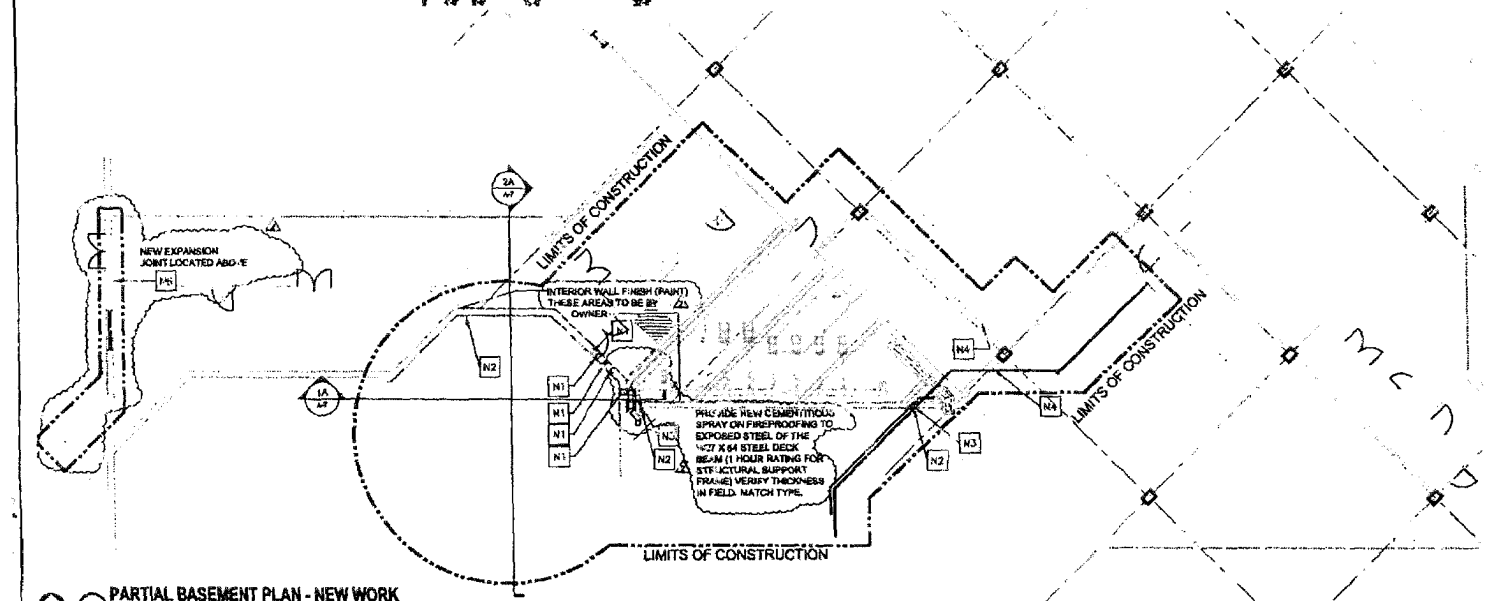


PARTIAL BASEMENT PLAN - DEMOLITION



PARTIAL BASEMENT PLAN - NEW WORK

GENERAL NOTES FOR DEMOLITION

A. VERIFY ALL CONDITIONS, DIMENSIONS AND MATERIALS IN THE FIELD.

B. IMMEDIATELY UPON DISCOVERY, BRING TO THE ATTENTION OF THE FIELD ARCHITECT ANY EXISTING MATERIALS OR STRUCTURAL MEMBERS WHICH ARE UNSTABLE, DETERIORATED OR OTHERWISE DAMAGED AND QUESTIONABLE FOR REUSE.

C. PROTECT ALL EXISTING FINISHES AND MATERIALS WHICH ARE TO REMAIN AS FINISHED MATERIALS OR AS A SUBSTRATE FOR A NEW FINISH MATERIAL.

D. REMOVE IMMEDIATELY FROM THE SITE ALL DEMOLISHED MATERIALS.

E. VERIFY EXISTING BELOW GRADE DRAIN TILE LOCATION IN AREA OF DEMOLITION /CONSTRUCTION. EXTEND TILE AS REQUIRED FOR NEW CONDITIONS.

SEQUENCE OF NEW CONSTRUCTION AND DEMOLITION - PHASING

A. PHASE 1. CONSTRUCTION OF THE NEW COOLING TOWER AND ITS RELATED CONSTRUCTION WITHIN THE COOLING TOWER MASONRY ENCLOSURE.

B. PHASE 2. DEMOLITION OF THE EXISTING COOLING TOWER AND COMPLETION OF THE REMAINING SITE WORK AND LANDSCAPING.

KEYED NOTES FOR DEMOLITION

1. EXISTING LOW CONCRETE STEM WALL OF COOLING TOWER , CONCRETE SLAB AND FOOTINGS TO REMAIN.
2. REMOVE EXISTING STEEL GRATE AND GRATE SUPPORT ANGLES FROM CONCRETE COOLING TOWER WALL.
3. SAW CUT EXISTING COOLING TOWER CONCRETE STEM WALLS TO THE LIMITS SHOWN - APPROXIMATELY 8'-0" BELOW GRADE. REFERENCE DEMOLITION WALL SECTIONS AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
4. CORE DRILL NEW SLEEVE OPENINGS IN FOUNDATION WALL FOR PIPING PENETRATIONS.
5. REMOVE PIPING. SEE MECHANICAL DRAWINGS.
6. PROVIDE AN ACCESS THRU EXISTING GYPSUM PARTITION FOR COMPLETION OF MEP WORK.
7. REMOVE EXPANSION JOINT AT FIRST LEVEL ABOVE MECHANICAL ROOM ENTRANCE. PREP AREA TO RECEIVE NEW WATER TIGHT JOINT.

KEYED NOTES FOR NEW WORK

N1. INFILL EXISTING CONCRETE FOUNDATION WALL TO ENCLOSE PENETRATION OPENINGS AFTER REMOVAL OF PIPING.

N2. WATERPROOFING SYSTEM WITH PROTECTION BOARD. SEE SPECIFICATIONS.

N3. PROVIDE WATERPROOFED SEAL AROUND PIPE PENETRATION PER WATERPROOFING SYSTEM MANUFACTURER.

N4. NEW PIPE PENETRATION IN EXISTING GYPSUM WALL CONSTRUCTION. IF PARTITION IS A RATED ASSEMBLY, PROVIDE U.L. LISTED PENETRATION DETAIL AS THE CONDITIONS WARRANT.

N5. REPAIR PARTITION TO ORIGINAL CONDITION AFTER MEP WORK IS COMPLETE.

N6. PROVIDE NEW COMPRESSIBLE EXP. JOINT AND SEAL BETWEEN PARKING STRUCTURE AND TUNNEL TO PREVENT MOISTURE PENETRATION TO SPACE BELOW. VERIFY CONDITION IN FIELD

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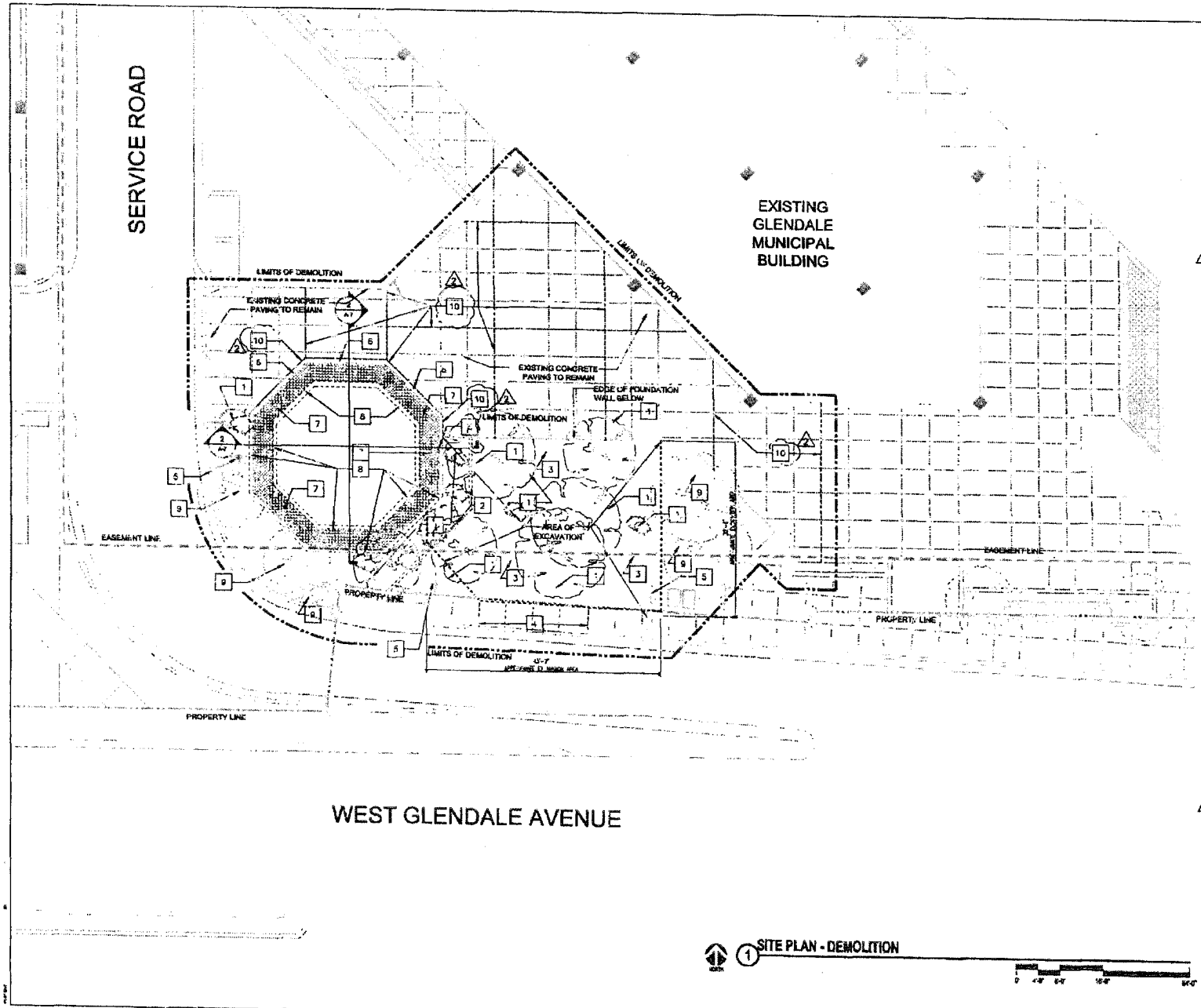

1 SITE PLAN - DEMOLITION

GENERAL NOTES FOR DEMOLITION

A. VERIFY ALL CONDITIONS, DIMENSIONS AND MATERIALS IN THE FIELD.

B. IMMEDIATELY UPON DISCOVERY, BRING TO THE ATTENTION OF THE FIELD ARCHITECT ANY EXISTING MATERIALS OR STRUCTURAL MEMBERS WHICH ARE UNSTABLE, DETERIORATED OR OTHERWISE DAMAGED AND QUESTIONABLE FOR REUSE.

C. PROTECT ALL EXISTING FINISHES AND MATERIALS WHICH ARE TO REMAIN AS FINISHED MATERIALS OR AS A SUBSTRATE FOR A NEW FINISH MATERIAL.

D. REMOVE IMMEDIATELY FROM THE SITE ALL DEMOLISHED MATERIALS.

E. CLEAN AND PREP EXISTING CONCRETE DECK SURFACE IN AREA OF WORK TO RECEIVE NEW PENETRATING COLLOIDAL CONCRETE TREATMENT.

SEQUENCE OF NEW CONSTRUCTION AND DEMOLITION - PHASING

A. PHASE 1. CONSTRUCTION OF THE NEW COOLING TOWER AND ITS RELATED CONSTRUCTION WITHIN THE COOLING TOWER MASONRY ENCLOSURE.

B. PHASE 2. DEMOLITION OF THE EXISTING COOLING TOWER AND COMPLETION OF THE REMAINING SITE WORK AND LANDSCAPING.

KEYED NOTES FOR DEMOLITION

1. REMOVE EXISTING VEGETATION INCLUDING BUT NOT LIMITED TO TREES, SHRUBS, ETC. FROM THE AREA OF EXCAVATION.
2. REMOVE EXISTING CONCRETE CURB TO THE LIMITS SHOWN ON THE DRAWING.
3. REMOVE EXISTING SITE ROCKS, RIP RAP, ETC FROM THE AREA OF EXCAVATION. SALVAGE AND STORE ON SITE FOR REINSTALLATION.
4. REMOVE EXISTING CONCRETE SIDEWALK TO THE LIMITS SHOWN ON THE DRAWING. LEAVE CONCRETE CURB INTACT.
5. EXISTING STREET LIGHT FIXTURES TO REMAIN.
6. EXISTING LOW CONCRETE STEM WALL OF COOLING TOWER TO REMAIN.
7. REMOVE EXISTING STEEL GRATE AND GRATE SUPPORT ANGLES FROM CONCRETE COOLING TOWER WALL.
8. SAW CUT EXISTING COOLING TOWER CONCRETE STEM WALLS TO THE LIMITS SHOWN - APPROXIMATELY 6'-0" BELOW GRADE. REFERENCE DEMOLITION WALL SECTIONS AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
9. EXISTING TREES AND VEGETATION TO REMAIN.
10. REMOVE EXISTING SEALANT (CAULK) AND PRE-MOLDED FILLER AT THE CONCRETE DECK EXPANSION JOINT LOCATIONS IN THE AREA OF DEMOLITION. CLEAN AND PREP JOINTS AND CONCRETE SURFACE TO RECEIVE NEW EXPANSION JOINT INFILL SYSTEM AND CONCRETE DECK SURFACE TREATMENT. VERIFY EXACT LOCATIONS IN THE FIELD.

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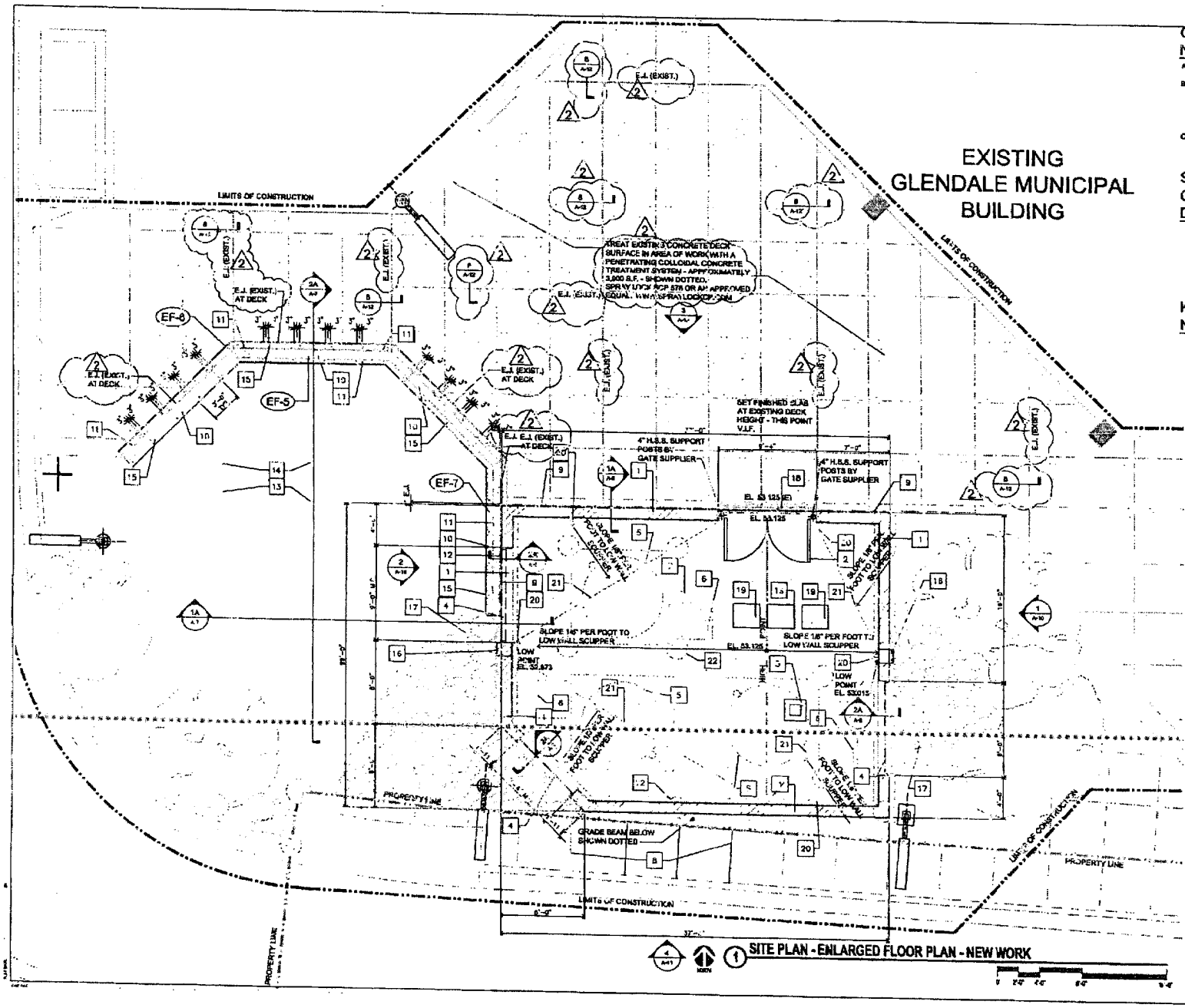

SITE PLAN - ENLARGED FLOOR PLAN - NEW WORK

GENERAL NOTES FOR NEW WORK

A. VERIFY ALL CONDITIONS, DIMENSIONS AND MATERIALS IN THE FIELD.
B. IMMEDIATELY UPON DISCOVERY, BRING TO THE ATTENTION OF THE FIELD ARCHITECT ANY EXISTING MATERIALS OR STRUCTURAL MEMBERS WHICH ARE UNSTABLE, DETERIORATED OR OTHERWISE DAMAGED AND QUESTIONABLE FOR REUSE.
C. PROTECT ALL EXISTING FINISHES AND MATERIALS WHICH ARE TO REMAIN AS FINISHED MATERIALS OR AS A SUBSTRATE FOR A NEW FINISH MATERIAL.

SEQUENCE OF NEW CONSTRUCTION AND DEMOLITION - PHASING

A. PHASE 1. CONSTRUCTION OF THE NEW COOLING TOWER AND ITS RELATED CONSTRUCTION WITHIN THE COOLING TOWER MASONRY ENCLOSURE.
B. PHASE 2. DEMOLITION OF THE EXISTING COOLING TOWER AND COMPLETION OF THE REMAINING SITE WORK AND LANDSCAPING.

KEYED NOTES FOR NEW WORK

1. NEW 12" CONCRETE MASONRY WALL WITH THREE COAT STUCCO FINISH ON THE EXTERIOR AND INTERIOR SIDE SIDE OF THE MASONRY WALLS. PROVIDE PRE-FINISHED METAL COPING AT TOP OF WALL.
2. PAIR OF 4'-0" X 6'-0" PRE-FINISHED ALUMINUM LOUVERED GATES INCLUDING HARDWARE. SUPPORT POSTS AND ALL MATERIALS REQUIRED FOR INSTALLATION BY THE GATE SUPPLIER.
3. FLOOR SINK WITH 6" HIGH CONCRETE CURB SURROUND. SEE PLUMBING DRAWINGS FOR FIXTURE INFORMATION.
4. PRE-FINISHED ALUMINUM LOUVERS.
6. COOLING TOWERS PER MECHANICAL.
6. STEEL LADDER AND PLATFORM PER STRUCTURAL DRAWINGS.
7. CONCRETE SLAB ON GRADE.
8. NEW CONCRETE SIDEWALK INFILL TO MATCH THE EXISTING TYPE AND CONSTRUCTION.
9. EXTERIOR GRADE COMPRESSIBLE EXPANSION JOINT BETWEEN EXISTING PLAZA DECK AND NEW FOUNDATION WALL. CS-HF SERIES OR AN APPROVED EQUAL.
10. ARCHITECTURAL CAST STONE WALL CAP.
11. NEW THREE COAT STUCCO FINISH ON EXISTING CAST IN PLACE CONCRETE WALL BELOW ARCHITECTURAL CAST STONE HARD-SCAPE WALL CAP.
12. FLASHING TRANSITION AT NEW MASONRY WALL AND EXISTING CAST IN PLACE CONCRETE WALL.
13. GRADE INFILL
14. LANDSCAPING BY OTHERS.
15. GRINDMINDER TM ANTI-SKATEBOARDING DETERRENT SYSTEM BY GRINDTOMALT.COM OR AN APPROVED EQUAL ANCHORED INTO CAST STONE WALL CAP. SPACING SHALL BE 3'-0" O.C.
16. THROUGH WALL CAST STONE SCUPPER AT BASE OF CMU WALL FOR DECK DRAINAGE.
17. RIP RAP FOR EROSION CONTROL.
18. EXTERIOR GRADE METAL EXPANSION JOINT COVER TO ACCOMMODATE VERTICAL OFFSETS IN CONCRETE DECKS AT GATE ENTRANCE ONLY.
19. 6" HIGH CONCRETE EQUIPMENT HOUSEKEEPING PAD.
20. LIGHT FIXTURE PER ELECTRICAL DRAWINGS.
21. SLOPE CONCRETE SLAB 1/8" PER PER FOOT TO SIDE WALL SCUPPERS.
22. CONCRETE PIERS PER STRUCTURAL.

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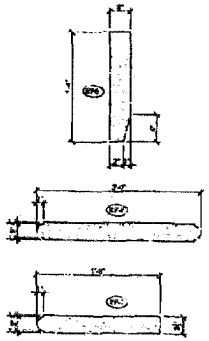
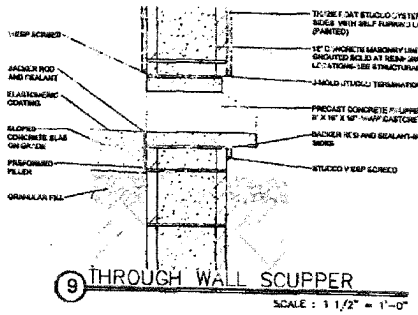
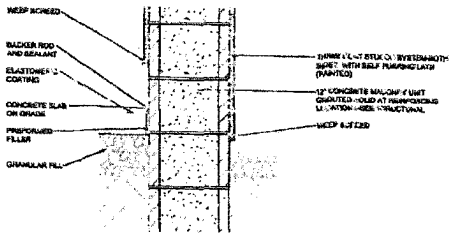


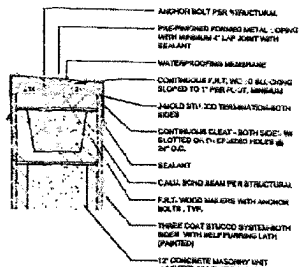
12 CAST STONE SHAPES
SCALE : 1 1/2" = 1'-0"



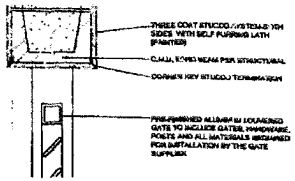
9 THROUGH WALL SCUPPER
SCALE : 1 1/2" = 1'-0"



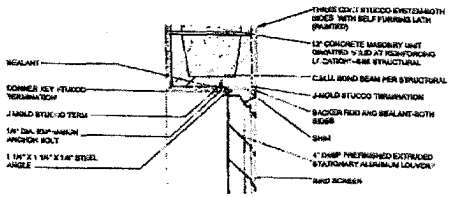
5 LOW WALL DETAIL AT FLOOR
SCALE : 1 1/2" = 1'-0"



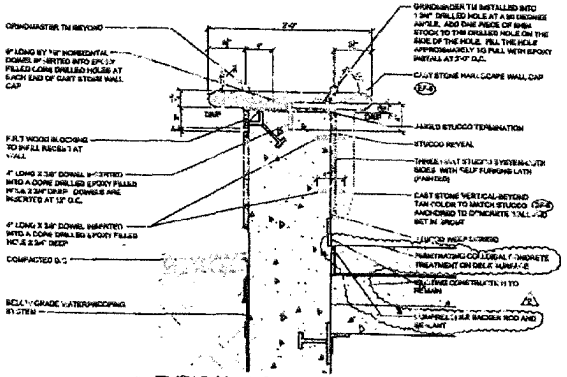
1 PARAPET DETAL
SCALE : 1 1/2" = 1'-0"



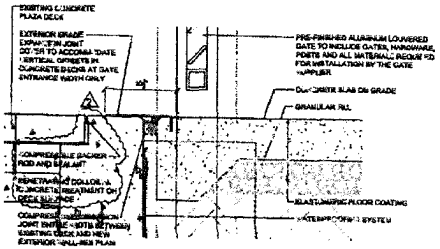
6 GATE HEAD DETAIL
SCALE : 1 1/2" = 1'-0"



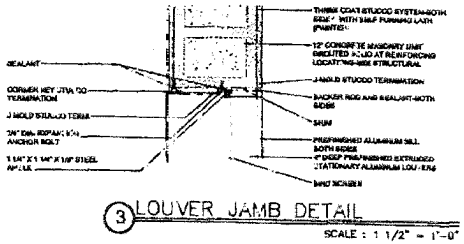
2 LOUVER HEAD DETAIL
SCALE : 1 1/2" = 1'-0"



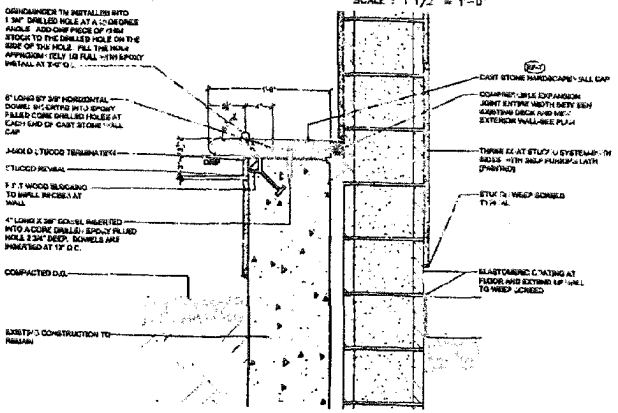
10 TYPICAL LOW WALL DETAIL
SCALE : 1 1/2" = 1'-0"



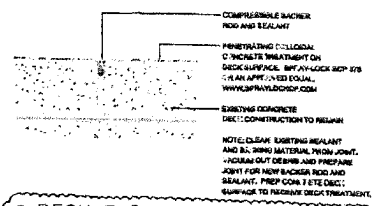
7 DECK EXPANSION JOINT COVER
SCALE : 1 1/2" = 1'-0"



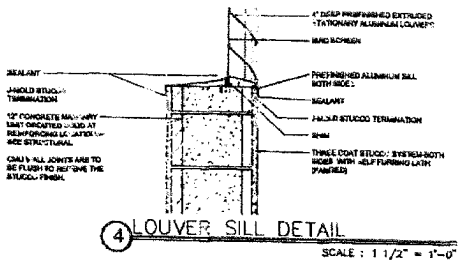
3 LOUVER JAMB DETAIL
SCALE : 1 1/2" = 1'-0"



11 TYPICAL LOW WALL DETAIL
SCALE : 1 1/2" = 1'-0"



8 DECK EXPANSION JOINT REPAIR
SCALE : 3" = 1'-0"



4 LOUVER SILL DETAIL
SCALE : 1 1/2" = 1'-0"

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PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

MAYOR
Jerry P. Weiers

COUNCIL MEMBERS
Jaime Aldama
Samuel U. Chavira
Ian Hugh
Ray Malnar
Lauren Tolmachoff
Bart Turner

ACTING CITY MANAGER
Richard A. Bowers

CITY ATTORNEY
Michael D. Bailey

CITY CLERK
Pamela Hanna

CITY ENGINEER
David D. Beard

GLENDALE

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TECHNICAL SPECIFICATIONS

NOTICE TO CONTRACTORS

Sealed bids shall be either mailed to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona, 85301, or hand-delivered to the Engineering Department office, third floor, 5850 West Glendale Avenue, Glendale, Arizona, for furnishing all plant, material, equipment and labor, and to complete construction of: **PROJECT NO. 141510 - CITY HALL COOLING TOWERS REPLACEMENT.** Furnish and install three (3) cooling towers on new structural platform as per plans and specifications. After install, contractor shall remove existing cooling towers and replace hardscape area as proposed in contract documents.

Bids must be received by the Engineering Department of the City of Glendale no later than 10:00 A.M., JANUARY 14, 2016. Any bid received after that time will not be considered and will be returned to the bidder. At that time, the bids will be publicly opened and read aloud in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona.

A MANDATORY pre-bid conference will be held on JANUARY 7, 2016, at 9:00 A.M., City Hall **(meet at 1st floor lobby area)**, 5850 West Glendale Avenue, Glendale, Arizona. Bidders, contractors, and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions.

Plans, specifications and contract documents may be examined, and copies may be obtained at City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona. A non-refundable charge of $25.00 shall be paid for each set of plans and specifications issued from this office.

Each bid shall be in accordance with the plans, specifications and contract documents, and shall be set forth and submitted on the BID DOCUMENTS included with the project specifications book. The BID DOCUMENTS may be removed from the project specifications book and submitted independently of such book. Each bid shall be accompanied by a proposal guarantee, in the form of a certified or cashier's check or bid bond for ten percent (10%) of the amount of bid, made payable to the order of the City of Glendale, Arizona, to insure that the successful bidder will enter into the contract if awarded to him and submit the required Certificate of Insurance, Payment Bond and Performance Bond. All proposal guarantees, except those of the three lowest qualified bidders, will be returned immediately following the opening and checking of proposals. The proposal guarantees of the three lowest qualified bidders will be returned immediately after the contract documents have been executed by the successful bidder. The proposal guarantee shall be declared forfeited as liquidated damages if the successful bidder refuses to enter into said contract or submit the Certificate of Insurance, Payment Bond and Performance Bond after being requested to do so by the City of Glendale, Arizona.

The City of Glendale reserves the right to reject any or all bids or waive any informality or irregularity in a bid. No bidder may withdraw his bid for a period of fifty (50) days after opening and reading of the bids.

The City of Glendale is an equal opportunity employer and minority business enterprises and women's business enterprises are encouraged to submit bids.

CITY OF GLENDALE, ARIZONA

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The Glendale Star

INFORMATION FOR BIDDERS

1. ELIGIBILITY OF CONTRACTORS: When calling for bids for contracts for public work to be performed on behalf of the State or any political subdivision thereof, which will be paid for from public funds, no bid shall be considered for performance of a contract, including construction work which is not submitted by a bidder duly licensed as a contractor in this State. No bid shall be awarded to any contractor or entity not authorized to do business in the State of Arizona by the Arizona Corporation Commission, as required by statute.

2. PROPOSAL: Bids to receive consideration shall be made in accordance with the following instructions:

(a) Before submitting a bid, bidders shall carefully examine the plans and specifications and contract documents, visit the site of the work, fully inform themselves as to all existing conditions and limitations.

(b) Bids shall be submitted on the "PROPOSAL" forms provided and delivered to the City of Glendale Engineering Department on or before the day and hour set in the "NOTICE TO CONTRACTORS," as published. Bids shall be enclosed in a sealed envelope marked on the outside lower right-hand corner indicating:

1. The bidder's name and address.
2. The project number.
3. The title of the project.
4. The time and date the bids are to be received.

(c) It is the sole responsibility of the bidder to see that his bid is received in proper time. Any bids received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

(d) The signatures of all persons shall be in longhand. Any interlineations, alterations, or erasures must be initialed by the signer of the bid.

(e) Bids shall not contain any recapitulations of the work to be done. No oral, telegraphic, telephonic, or modified proposals will be considered.

3. BID SECURITY: Each proposal shall be accompanied by a proposal guarantee in the form of a certified or cashier's check or bid bond, with a properly executed Power of Attorney attached, in an amount equal at least to ten percent (10%) of the proposal payable without condition to the City. If a bid bond is submitted with the bid it shall be issued by a company licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing the bid bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid.** The proposal guarantee shall guarantee that the bidder, if awarded the contract, will, within ten (10) working days after the award, execute such contract in accordance with the proposal and in manner and form required by the contract documents, and will furnish good and sufficient bond for the faithful performance of the same, a payment bond and a certificate of insurance. The bid securities of the three (3) lowest bidders will be retained until the contract is awarded, or other disposition made thereof. The bid securities of all bidders, except the three (3) lowest, will be returned promptly after the canvass of bids. In the event the Contractor fails, within ten (10)

working days after the award, to execute said Contract and deliver the Performance and Labor and Material Payment Bonds and the Certificate of Insurance, the Bid Security shall become the property of the City.

4. WITHDRAWAL OF BID: Any bidder may withdraw his bid, either personally, by telegram or by written request, at any time prior to the scheduled closing time for receipt of bids. No bid may be withdrawn by telephone. Any bid withdrawn will not be opened and will be returned to the bidder. After opening and reading of the bids, no bidder may withdraw his bid for a period of fifty (50) days from the date of opening and reading.

5. LATE BIDS: Bids received after the scheduled closing time for receipt of bids, as contained in the "Notice to Contractors," will not be considered and will be returned to the bidder.

6. AWARD OR REJECTION OF BIDS: The contract will be awarded to the lowest and best qualified responsive bidder complying with these instructions and with the "NOTICE TO CONTRACTORS." The City of Glendale, Arizona, however, reserves the right to accept or reject any or all bids or to waive any or all informalities or irregularities in the bid. Alternates may be accepted depending upon the availability of City funds. Accepted alternates will be considered in determining the lowest responsive and responsible bidder.

7. BIDDERS INTERESTED IN MORE THAN ONE BID: No person, firm or corporation shall be allowed to make, file, or be interested in more than one (1) bid for the same work unless alternate bids are called for in the specifications or any addenda. A person, firm, or corporation who has submitted a sub-proposal to a bidder, or who has quoted prices on materials to a bidder is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders.

8. CONTRACT AND BONDS: The form of contract, which the successful bidder as Contractor will be required to execute and the forms of bonds which he shall be required to furnish are included in the contract documents and should be carefully examined by the bidder. The successful bidder shall use the forms provided or such other forms as are acceptable by the City. The Contract and Performance and Labor and Material Payment Bonds will be executed in three (3) original counterparts. All bonds shall be issued by companies licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing any bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid.**

9. INSURANCE REQUIREMENTS: Contractor, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed. Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate. **Contracts in excess of $250,000 shall require $2,000,000 single occurrence/$5,000,000 annual aggregate.**

Sub-contractors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU

hazards if requested by the City, and a separation of insurance provision.

These limits may be met through a combination of primary and excess liability coverage.

Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and $1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

10. SUBCONTRACTORS LISTING AND CERTIFICATION OF CONTRACT COMPLIANCE: The contractor will be required to furnish the form of subcontractors listing and certification of contract compliance with the executed contract documents. This information is requested for tracking and insurance purposes only.

11. INTERPRETATION OF PLANS AND DOCUMENTS: If any person contemplating a bid for proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the plans and specifications, he may submit to the Engineering Department, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Questions received less than ninety-six (96) hours before the bid opening time may not be answered. Any interpretation or correction of the documents will be made only by Addendum, duly issued and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The City of Glendale will not be responsible for any other explanations or interpretations of the proposed documents.

12. CHANGES TO PLANS AND DOCUMENTS: Any changes to the plans and documents shall be made only by Addendum. No verbal or other changes to the plans and documents will be valid. A copy of each Addendum will be mailed or delivered as provided in Section 13 below.

13. ADDENDUM: Any addenda will be faxed, mailed or delivered to all who are known by the City to have received a complete set of bid documents, and to offices where bid documents have been filed for review purposes. It is the responsibility of each bidder to ascertain that he has received all addenda issued by telephoning the office identified in the NOTICE TO CONTRACTORS as the location where bid documents are available prior to submitting his bid.

Bidders shall acknowledge all addenda in the appropriate location on the "PROPOSAL" form. Failure to acknowledge receipt of Addenda shall render the bid proposal non-responsive and it will be rejected.

14. ASSIGNMENT OF CONTRACT: No assignment by the Contractor of any contract to be entered into hereunder, or any part thereof, or of funds to be received thereunder by the Contractor, will be recognized by the Owner unless such assignment has had prior approval of the Owner, and

the Surety has been given due notice of such assignment in writing and has consented thereto in writing.

15. PLANS AND SPECIFICATIONS TO SUCCESSFUL BIDDER: The successful bidder may obtain five (5) sets of plans and specifications for this project from the City.

16. TIME OF COMPLETION: The Contractor shall commence work under this project on or before the tenth day following receipt of the Notice to Proceed for that project from the City of Glendale and shall fully complete all work under the project within NINETY (90) consecutive calendar days from and including the date of receipt of such Notice to Proceed. Time is of the essence in the completion of all work required under this contract. The Contractor shall, at all times, during the continuance of the contract, prosecute the work with such force and equipment as is sufficient to complete all work within the time specified.

17. CITY OF GLENDALE TRANSACTION PRIVILEGE TAX: The City of Glendale transaction privilege tax shall **NOT** be waived under the provisions of this contract. The current privilege tax rate can be obtained from the City of Glendale Sales Tax and Licenses Department. The Contractor shall be responsible for reporting and payment of all city, county, state or federal taxes.

18. PRE-BID CONFERENCE: A MANDATORY pre-bid conference will be held on JANUARY 7, 2016, at 9:00 A.M., City Hall **(meet at 1st floor lobby area)**, 5850 West Glendale Avenue, Glendale, Arizona. Bidders, contractors, and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions.

19. ALTERNATES: Alternate proposals will not be considered unless called for in the documents or any addenda thereto. When alternates are requested, all requested alternates or alternate bid items, unless otherwise stated, shall be bid. If no change in the base bid will occur with the alternate, enter "No Change."

20. APPROVAL OF SUBSTITUTIONS: The materials, products and equipment described in the Documents and Addenda establish a standard or required function, dimension, appearance and quality to be met by any proposed substitution. No substitute will be considered, before bid opening, unless written request for approval has been received by the City Engineer at least ten (10) working days prior to the scheduled closing time for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including any drawings, cuts, performance and test data and any other information necessary for evaluation of the substitute. Bidder shall not be entitled to approval of a substitute.

If a substitute is approved, the approval shall be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

21. USE OF "EQUALS": When the specifications for materials, articles, products and equipment state "or equal," contractor may bid upon, and use materials, articles, products and equipment which will perform equally the duties imposed by the general design. The City Engineering Department will have the final approval of all materials, articles, products and equipment proposed to be used as an "equal." It shall not be purchased or installed without the prior written approval from the City Engineering Department.

Approvals for "equals," before bid opening, may be requested in writing to the City Engineering Department for approval. Requests must be received at least ten (10) days prior to the date set for opening the Bid Proposals. The request shall state the name of the material, article, product or equipment for which the item is sought to be considered an equal and a complete description of the proposed equal including any drawings, cuts, performance and test data and any other information necessary for approval of the equal. All approvals will be issued in the form of an addendum.

22. EXAMINATION OF CONTRACT DOCUMENTS AND VISIT SITE: Before submitting a Bid Proposal, bidders should carefully examine the Contract Documents, visit the site of the work, fully inform themselves as to all existing conditions and limitations. No consideration will be granted for any alleged misunderstanding of the material, articles or piece of equipment to be furnished or work to be done. It is understood that the tender of the Bid Proposal carries with it the agreement to all items and conditions referred to herein or indicated in the Contract Documents.

23. BIDDERS IN DEFAULT: No bid will be awarded to any person, firm or corporation that is not authorized by the Arizona Corporation Commission to do business in the State of Arizona, in arrears or is in default to the City of Glendale upon any debt or contract, or that is a defaulter as surety or otherwise upon any obligation to the City of Glendale, or has failed to faithfully perform any previous contract with the City of Glendale.

END OF INFORMATION FOR BIDDERS

PROPOSAL

Place Glendale, AZ

Date January 20, 2016

Proposal of Caliente Construction, Inc, a Corporation organized and existing under the laws of the State of Arizona. a partnership consisting of N/A; or an individual trading as N/A.

TO THE HONORABLE MAYOR AND COUNCIL
CITY OF GLENDALE
GLENDALE, ARIZONA

Gentlemen:

The undersigned hereby proposes and agrees to furnish any and all required labor, materials, construction equipment, transportation and services for the construction of: **PROJECT 141510 - CITY HALL COOLING TOWERS REPLACEMENT**, in strict conformity with the plans and specifications for the following unit prices:

(Extension of these unit prices on the basis of estimated quantities and the totaling of these extensions are for the purpose of comparing bids only. The mathematics of such extensions and totaling will be checked and corrected by the Engineering Department, before evaluating the bids, and the lowest of such corrected and checked totals will determine the lowest bids.)

CITY OF GLENDALE

PROJECT NUMBER: 141510

PROJECT: CITY HALL COOLING TOWERS REPLACEMENT

REVISED JANUARY 13, 2016

REVISED BID SCHEDULE

BASE BID

ITEM NO.	DESCRIPTION	QTY	TOTAL COST
A	Mobilization / Demobilization	LS	$6,163.00
B	Demolition	LS	$106,521.00
C	Architectural	LS	$208,128.00
D	Concrete	LS	$83,248.00
E	Structural & Misc. Steel	LS	$47,492.00
F	Plumbing	LS	w/Mechanical
G	Mechanical	LS	$437,845.00
H	Electrical	LS	$55,517.00
I	Controls	LS	w/Mechanical
J	Misc. Items	LS	n/a
K	Owner's Contingency	LS	**$75,000.00**
	BASE BID COST:		$1,019,907.00 1019,914.

0.*
6.163.00+
106.521.00+
208.128.00+
83.248.00+
47.492.00+
437.845.00+
55.517.00+
75.000.00+
1.019.914.00*

20.093.00+
1.040.007.00*

ALTERNATE #1

A	Furnish and Install Circulating Pumps	LS	$28,093.00
	TOTAL ALT. #1 & BASE BID COST:		$1,048,000.00 1,048,007.

The undersigned hereby declares that he has visited the site(s) and has carefully examined the contract documents relating to the work covered by the above bid or bids.

Upon receipt of notice of the acceptance of this bid, we will execute the formal contract attached within ten (10) days, and will deliver a one hundred percent (100%) Performance Bond for the faithful performance of this Contract, together with a one hundred percent (100%) Payment Bond and Certificate of Insurance.

The bid security attached, with endorsement, in the sum of ten percent (10%) of the total bid, is to become the property of the City of Glendale, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for the delay and additional work caused thereby.

The undersigned has checked carefully all the above figures and understands that the City of Glendale, Arizona, will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

The undersigned understands that the Mayor and Council of the City of Glendale, Arizona, reserves the right to reject any or all bids or to waive any informalities or irregularities in the bid.

Respectfully submitted,

Arizona Contractor's Classification and License No.

ROC 091625

Caliente Construction Inc.
Contractor

By _____
Lorraine Bergman, President/CEO

485 W. Vaughn St.

Tempe, AZ 85283
(Complete business address)

Telephone Number: (480) 894-5500
Fax Number (480) 894-2323

Bidder shall signify receipt of all Addenda here (if any):

January 13, 2016, Addendum No. 1

Failure to acknowledge receipt of all Addenda shall render the bid proposal non-responsive and will be rejected.

Acknowledged by _____
Lorraine Bergman, President/CEO

CITY CLERK
ORIGINAL

C-10781
04/12/2016

CONSTRUCTION AGREEMENT

This Construction Agreement ("Agreement") is entered into and effective between the CITY OF GLENDALE, an Arizona municipal corporation ("City"), and Caliente Construction, Inc., an Arizona corporation ("Contractor") as of the 12 day of April, 2016.

RECITALS

A. City intends to undertake a project for the benefit of the public and with public funds that is more fully set forth in the **Notice to Contractors** and the attached **Exhibit A** ("Project");

B. City desires to retain the services of Contractor to perform those specific duties and produce the specific work as set forth in the Project, the plans and specifications, the **Information for Bidders,** and the **Maricopa Association of Governments** ("MAG") **General and Supplemental Conditions and Provisions**;

C. City and Contractor desire to memorialize their agreement with this document.

AGREEMENT

In consideration of the Recitals, which are confirmed as true and correct and incorporated by this reference, the mutual promises and covenants contained in this Agreement, and other good and valuable consideration, City and Contractor agree as follows:

1. Project.

1.1 Scope. Contractor will provide all services and material necessary to assure the Project is completed timely and efficiently consistent with Project requirements, including, but not limited to, working in close interaction and interfacing with City and its designated employees, and working closely with others, including other contractors, providers or consultants retained by City.

1.2 Documents. The following documents are, by this reference, entirely incorporated into this Agreement and attached Exhibits as though fully set forth herein:

(A) Notice to Contractors;
(B) Information for Bidders;
(C) MAG General Conditions, Supplemental General Conditions, Special and Technical Provisions;
(D) Proposal;
(E) Bid Bond;
(F) Payment Bond;
(G) Performance Bond;
(H) Certificate of Insurance;
(I) Appendix; and
(J) Plans and Addenda thereto.

Should a conflict exist between this Agreement (and its attachments), and any of the incorporated documents as listed above, the provisions of this Agreement shall govern.

1.3 Project Team.

(A) Project Manager. Contractor will designate an employee as Project Manager with sufficient training, knowledge, and experience to, in the City's opinion, to complete the project and handle all aspects of the Project such that the work produced by Contractor is consistent with applicable standards as detailed in this Agreement.

(B) Project Team.

(1) The Project manager and all other employees assigned to the project by Contractor will comprise the "Project Team."

(2) Project Manager will have responsibility for and will supervise all other employees assigned to the project by Contractor.

(C) Sub-contractors.

(1) Contractor may engage specific technical contractor (each a "Sub-contractor") to furnish certain service functions.

(2) Contractor will remain fully responsible for Sub-contractor's services.

(3) Sub-contractors must be approved by the City, unless the Sub-contractor was previously mentioned in the response to the solicitation.

(4) Contractor shall certify by letter that contracts with Sub-contractors have been executed incorporating requirements and standards as set forth in this Agreement.

2. **Schedule.** The Project will be undertaken in a manner that ensures it is completed in a timely and efficient manner. If not otherwise stated in **Exhibit A**, the Project shall be completed by no later than within ninety (90) consecutive calendar days from and including the date of receipt of the Notice to Proceed.

3. **Contractor's Work.**

3.1 Standard. Contractor must perform services in accordance with the standards of due diligence, care, and quality prevailing among contractors having substantial experience with the successful furnishing of services and materials for projects that are equivalent in size, scope, quality, and other criteria under the Project and identified in this Agreement.

3.2 Licensing. Contractor warrants that:

(A) Contractor and Sub-contractors will hold all appropriate and required licenses, registrations and other approvals necessary for the lawful furnishing of services ("Approvals"); and

(B) Neither Contractor nor any Sub-contractor has been debarred or otherwise legally excluded from contracting with any federal, state, or local governmental entity ("Debarment").

(1) City is under no obligation to ascertain or confirm the existence or issuance of any Approvals or Debarments or to examine Contractor's contracting ability.

(2) Contractor must notify City immediately if any Approvals or Debarment changes during the Agreement's duration and the failure of the Contractor to notify City as required will constitute a material default of this Agreement.

3.3 Compliance. Services and materials will be furnished in compliance with applicable federal, state, county and local statutes, rules, regulations, ordinances, building codes, life safety codes, or other standards and criteria designated by City.

3.4 Coordination; Interaction.

(A) If the City determines that the Project requires the coordination of professional services or other providers, Contractor will work in close consultation with City to proactively interact with any other contractors retained by City on the Project ("Coordinating Entities").

(B) Subject to any limitations expressly stated in the budget, Contractor will meet to review the Project, schedules, budget, and in-progress work with Coordinating Entities and the City as often and for durations as City reasonably considers necessary in order to ensure the timely work delivery and Project completion.

(C) If the Project does not involve Coordinating Entities, Contractor will proactively interact with any other contractors when directed by City to obtain or disseminate timely information for the proper execution of the Project.

3.5 Hazardous Substances. Contractor is responsible for the appropriate handling, disposal of, and if necessary, any remediation and all losses and damages to the City, associated with the use or release of hazardous substances by Contractor in connection with completion of the Project.

3.6 **Warranties.** At any time within two years after completion of the Project, Contractor must, at Contractor's sole expense and within 20 days of written notice from the City, uncover, correct and remedy all defects in Contractor's work. City will accept a manufacturer's warranty on approved equipment as satisfaction of the Contractor's warranty under this subsection.

3.7. **Bonds.** Upon execution of this Agreement, and if applicable, Contractor must furnish Payment and Performance bonds as required under A.R.S. § 34-608.

4. Compensation for the Project.

4.1 **Compensation.** Contractor's compensation for the Project, including those furnished by its Sub-contractors will not exceed $1,048,007.00, as specifically detailed in the Contractor's bid and set forth in **Exhibit B** ("Compensation").

4.2 **Change in Scope of Project.** The Compensation may be equitably adjusted if the originally contemplated scope of services as outlined in the Project is significantly modified by the City.

(A) Adjustments to the Scope or Compensation require a written amendment to this Agreement and may require City Council approval.

(B) Additional services which are outside the scope of the Project and not contained in this Agreement may not be performed by the Contractor without prior written authorization from the City.

5. Billings and Payment.

5.1 **Applications.**

(A) The Contractor will submit monthly invoices (each, a "Payment Application") to City's Project Manager and City will remit payments based upon the Payment Application as stated below.

(B) The period covered by each Payment Application will be one calendar month ending on the last day of the month.

5.2 **Payment.**

(A) After a full and complete Payment Application is received, City will process and remit payment within 30 days.

(B) Payment may be subject to or conditioned upon City's receipt of:

(1) Completed work generated by Contractor and its Sub-contractors; and

(2) Unconditional waivers and releases on final payment from Sub-contractors as City may reasonably request to assure the Project will be free of claims arising from required performances under this Agreement.

5.3 **Review and Withholding.** City's Project Manager will timely review and certify Payment Applications.

(A) If the Payment Application is rejected, the Project Manager will issue a written listing of the items not approved for payment.

(B) City may withhold an amount sufficient to pay expenses that City reasonably expects to incur in correcting the deficiency or deficiencies rejected for payment.

(C) Contractor will provide, by separate cover, and concurrent with the execution of this Agreement, all required financial information to the City, including City of Glendale Transaction Privilege License and Federal Taxpayer identification numbers.

(D) City will temporarily withhold Compensation amounts as required by A.R.S. 34-221(C).

6. **Termination.**

6.1 **For Convenience.** City may terminate this Agreement for convenience, without cause, by delivering a written termination notice stating the effective termination date, which may not be less than 15 days following the date of delivery.

(A) Contractor will be equitably compensated any services and materials furnished prior to receipt of the termination notice and for reasonable costs incurred.

(B) Contractor will also be similarly compensated for any approved effort expended and approved costs incurred that are directly associated with Project closeout and delivery of the required items to the City.

6.2 **For Cause.** City may terminate this Agreement for cause if Contractor fails to cure any breach of this Agreement within seven days after receipt of written notice specifying the breach.

(A) Contractor will not be entitled to further payment until after City has determined its damages. If City's damages resulting from the breach, as determined by City, are less than the equitable amount due but not paid Contractor for Service and Repair furnished, City will pay the amount due to Contractor, less City's damages.

(B) If City's direct damages exceed amounts otherwise due to Contractor, Contractor must pay the difference to City immediately upon demand; however, Contractor will not be subject to consequential damages more than $1,000,000 or the amount of this Agreement, whichever is greater.

7. **Insurance.**

7.1 **Requirements.** Contractor must obtain and maintain the following insurance ("Required Insurance"):

(A) Contractor and Sub-contractors. Contractor, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described below (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed.

(B) General Liability.

(1) Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate.

(2) Sub-contactors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

(3) This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU hazards if requested by the City, and a separation of insurance provision.

(4) These limits may be met through a combination of primary and excess liability coverage.

(C) Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and 1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

(D) Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

(E) Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

(F) Notice of Changes. Contractor's Policies must provide for not less than 30 days' advance written notice to City Representative of:

(1) Cancellation or termination of Contractor or Sub-contractor's Policies;

(2) Reduction of the coverage limits of any of Contractor or and Sub-contractor's Policies; and

(3) Any other material modification of Contractor or Sub-contractor's Policies related to this Agreement.

(G) Certificates of Insurance.

(1) Within 10 business days after the execution of the Agreement, Contractor must deliver to City Representative certificates of insurance for each of Contractor and Sub-contractor's Policies, which will confirm the existence or issuance of Contractor and Sub-contractor's Policies in accordance with the provisions of this section, and copies of the endorsements of Contractor and Sub-contractor's Policies in accordance with the provisions of this section.

(2) City is and will be under no obligation either to ascertain or confirm the existence or issuance of Contractor and Sub-contractor's Policies, or to examine Contractor and Sub-contractor's Policies, or to inform Contractor or Sub-contractor in the event that any coverage does not comply with the requirements of this section.

(3) Contractor's failure to secure and maintain Contractor Policies and to assure Sub-contractor policies as required will constitute a material default under this Agreement.

(H) Other Contractors or Vendors.

(1) Other contractors or vendors that may be contracted by Contractor with in connection with the Project must procure and maintain insurance coverage as is appropriate to their particular agreement.

(2) This insurance coverage must comply with the requirements set forth above for Contractor's Policies (e.g., the requirements pertaining to endorsements to name the parties as additional insured parties and certificates of insurance).

(I) Policies. Except with respect to workers' compensation and employer's liability coverages, the City must be named and properly endorsed as additional insureds on all liability policies required by this section.

(1) The coverage extended to additional insureds must be primary and must not contribute with any insurance or self insurance policies or programs maintained by the additional insureds.

(2) All insurance policies obtained pursuant to this section must be with companies legally authorized to do business in the State of Arizona and acceptable to all parties.

7.2 Sub-contractors.

(A) Contractor must also cause its Sub-contractors to obtain and maintain the Required Insurance.

(B) City may consider waiving these insurance requirements for a specific Sub-contractor if City is satisfied the amounts required are not commercially available to the Sub-contractor and the insurance the Sub-contractor does have is appropriate for the Sub-contractor's work under this Agreement.

(C) Contractor and Sub-contractors must provide to the City proof of Required Insurance whenever requested.

7.3 **Indemnification.**

(A) To the fullest extent permitted by law, Contractor must defend, indemnify, and hold harmless City and its elected officials, officers, employees and agents (each, an "Indemnified Party," collectively, the "Indemnified Parties"), for, from, and against any and all claims, demands, actions, damages, judgments, settlements, personal injury (including sickness, disease, death, and bodily harm), property damage (including loss of use), infringement, governmental action and all other losses and expenses, including attorneys' fees and litigation expenses (each, a "Demand or Expense"; collectively, "Demands or Expenses") asserted by a third-party (i.e. a person or entity other than City or Contractor) and that arises out of or results from the breach of this Agreement by the Contractor or the Contractor's negligent actions, errors or omissions (including any Sub-contractor or other person or firm employed by Contractor), whether sustained before or after completion of the Project.

(B) This indemnity and hold harmless policy applies even if a Demand or Expense is in part due to the Indemnified Party's negligence or breach of a responsibility under this Agreement, but in that event, Contractor shall be liable only to the extent the Demand or Expense results from the negligence or breach of a responsibility of Contractor or of any person or entity for whom Contractor is responsible.

(C) Contractor is not required to indemnify any Indemnified Parties for, from, or against any Demand or Expense resulting from the Indemnified Party's sole negligence or other fault solely attributable to the Indemnified Party.

7.4 **Waiver of Subrogation.** Contractor waives, and will require any Subcontractor to waive, all rights of subrogation against the City to the extent of all losses or damages covered by any policy of insurance.

8. **Immigration Law Compliance.**

8.1 Contractor, and on behalf any subcontractor, warrants, to the extent applicable under A.R.S. § 41-4401, compliance with all federal immigration laws and regulations that relate to their employees as well as compliance with A.R.S. § 23-214(A) which requires registration and participation with the E-Verify Program.

8.2 Any breach of warranty under subsection 8.1 above is considered a material breach of this Agreement and is subject to penalties up to and including termination of this Agreement.

8.3 City retains the legal right to inspect the papers of any Contractor or subcontractor employee who performs work under this Agreement to ensure that the Contractor or any subcontractor is compliant with the warranty under subsection 8.1 above.

8.4 City may conduct random inspections, and upon request of City, Contractor shall provide copies of papers and records of Contractor demonstrating continued compliance with the warranty under subsection 8.1 above. Contractor agrees to keep papers and records available for inspection by the City during normal business hours and will cooperate with City in exercise of its statutory duties and not deny access to its business premises or applicable papers or records for the purposes of enforcement of this section 8.

8.5 Contractor agrees to incorporate into any subcontracts under this Agreement the same obligations imposed upon Contractor and expressly accrue those obligations directly to the benefit of the City. Contractor also agrees to require any subcontractor to incorporate into each of its own subcontracts under this Agreement the same obligations above and expressly accrue those obligations to the benefit of the City.

8.6 Contractor's warranty and obligations under this section to the City is continuing throughout the term of this Agreement or until such time as the City determines, in its sole discretion, that Arizona law has been modified in that compliance with this section is no longer a requirement.

8.7 The "E-Verify Program" above means the employment verification program administered by the United States Department of Homeland Security, the Social Security Administration, or any successor program.

9. **Conflict.** Contractor acknowledges this Agreement is subject to A.R.S. § 38-511, which allows for cancellation of this Agreement in the event any person who is significantly involved in initiating, negotiating, securing, drafting, or

creating the Agreement on City's behalf is also an employee, agent, or consultant of any other party to this Agreement.

10. Non-Discrimination Policies. Contractor must not discriminate against any employee or applicant for employment on the basis of race, religion, color sex or national origin. Contractor must develop, implement and maintain non-discrimination policies and post the policies in conspicuous places visible to employees and applicants for employment. Contractor will require any Sub-contractor to be bound to the same requirements as stated within this section.

11. Notices.

11.1 A notice, request or other communication that is required or permitted under this Agreement (each a "Notice") will be effective only if:

(A) The Notice is in writing, and

(B) Delivered in person or by private express overnight delivery service (delivery charges prepaid), certified or registered mail (return receipt requested).

(C) Notice will be deemed to have been delivered to the person to whom it is addressed as of the date of receipt, if:

(1) Received on a business day, or before 5:00 p.m., at the address for Notices identified for the Party in this Agreement by U.S. Mail, hand delivery, or overnight courier on or before 5:00 p.m.; or

(2) As of the next business day after receipt, if received after 5:00 p.m.

(D) The burden of proof of the place and time of delivery is upon the Party giving the Notice.

(E) Digitalized signatures and copies of signatures will have the same effect as original signatures.

11.2 **Representatives.**

(A) Contractor. Contractor's representative ("Contractor's Representative") authorized to act on Contractor's behalf with respect to the Project, and his or her address for Notice delivery is:

Caliente Construction Inc.
Attn: Lorraine Bergman
485 West Vaughn Street
Tempe, Arizona 85283

(B) City. City's representative ("City's Representative") authorized to act on City's behalf, and his or her address for Notice delivery is:

City of Glendale
Attn: Michael Johnson
5850 West Glendale Avenue
Glendale, Arizona 85301

With required copies to:

City of Glendale
City Manager
5850 West Glendale Avenue
Glendale, Arizona 85301

City of Glendale
City Attorney
5850 West Glendale Avenue
Glendale, Arizona 85301

(C) Concurrent Notices.

(1) All notices to City's representative must be given concurrently to City Manager and City Attorney.

(2) A notice will not be considered to have been received by City's representative until the time that it has also been received by City Manager and City Attorney.

(3) City may appoint one or more designees for the purpose of receiving notice by delivery of a written notice to Contractor identifying the designee(s) and their respective addresses for notices.

(D) **Changes.** Contractor or City may change its representative or information on Notice, by giving Notice of the change in accordance with this section at least ten days prior to the change.

12. **Financing Assignment.** City may assign this Agreement to any City-affiliated entity, including a non-profit corporation or other entity whose primary purpose is to own or manage the Project.

13. **Entire Agreement; Survival; Counterparts; Signatures.**

13.1 Integration. This Agreement contains, except as stated below, the entire agreement between City and Contractor and supersedes all prior conversations and negotiations between the parties regarding the Project or this Agreement.

(A) Neither Party has made any representations, warranties or agreements as to any matters concerning the Agreement's subject matter.

(B) Representations, statements, conditions, or warranties not contained in this Agreement will not be binding on the parties.

(C) Any solicitation, addendums and responses submitted by the Contractor are incorporated fully into this Agreement as Exhibit A. Any inconsistency between Exhibit A and this Agreement will be resolved by the terms and conditions stated in this Agreement.

13.2 Interpretation.

(A) The parties fairly negotiated the Agreement's provisions to the extent they believed necessary and with the legal representation they deemed appropriate.

(B) The parties are of equal bargaining position and this Agreement must be construed equally between the parties without consideration of which of the parties may have drafted this Agreement.

(C) The Agreement will be interpreted in accordance with the laws of the State of Arizona.

13.3 Survival. Except as specifically provided otherwise in this Agreement each warranty, representation, indemnification and hold harmless provision, insurance requirement, and every other right, remedy and responsibility of a Party, will survive completion of the Project, or the earlier termination of this Agreement.

13.4 Amendment. No amendment to this Agreement will be binding unless in writing and executed by the parties. Any amendment may be subject to City Council approval.

13.5 Remedies. All rights and remedies provided in this Agreement are cumulative and the exercise of any one or more right or remedy will not affect any other rights or remedies under this Agreement or applicable law.

13.6 Severability. If any provision of this Agreement is voided or found unenforceable, that determination will not affect the validity of the other provisions, and the voided or unenforceable provision will be reformed to conform to applicable law.

14.7 Counterparts. This Agreement may be executed in counterparts, and all counterparts will together comprise one instrument.

14. **Dispute Resolution.** Each claim, controversy and dispute ("Dispute") between Contractor and City will be resolved in accordance with Exhibit C. The final determination will be made by the City.

15. **Exhibits.** The following exhibits, with reference to the term in which they are first referenced, are incorporated by this reference.

Exhibit A	Project
Exhibit B	Compensation
Exhibit C	Dispute Resolution

The parties enter into this Agreement as of the date shown above.

City of Glendale,
an Arizona municipal corporation

By: Kevin R. Phelps
Its: City Manager

ATTEST:

City Clerk (SEAL)

APPROVED AS TO FORM:

City Attorney

Caliente Construction, Inc.
An Arizona corporation

By: Lorraine Bergman
Its: President/CEO

WOMEN-OWNED/MINORITY BUSINESS [ ] YES [ ] NO
CITY OF GLENDALE TRANSACTION PRIVILEGE TAX NO. _____
FEDERAL TAXPAYER IDENTIFICATION NO. _____

The parties enter into this Agreement as of the date shown above.

City of Glendale,
an Arizona municipal corporation

By: Kevin R. Phelps
Its: City Manager

ATTEST:

City Clerk (SEAL)

APPROVED AS TO FORM:

City Attorney

Caliente Construction, Inc.
An Arizona corporation

By: Lorraine Bergman
Its: President/CEO

WOMEN-OWNED/MINORITY BUSINESS [✓] YES [ ] NO
CITY OF GLENDALE TRANSACTION PRIVILEGE TAX NO. 500015742
FEDERAL TAXPAYER IDENTIFICATION NO. 86-0697201

EXHIBIT A
CONSTRUCTION AGREEMENT

PROJECT

Furnish and install three (3) cooling towers on new structural platform as per plans and specifications. After install, contractor shall remove existing cooling towers and replace hardscape area as proposed in contract documents. ALTERNATE #1: Furnish and install six (6) circulating pumps as per plans and specifications.

EXHIBIT B
CONSTRUCTION AGREEMENT

COMPENSATION

METHOD AND AMOUNT OF COMPENSATION

By bid, including all services, materials and costs.

NOT-TO-EXCEED AMOUNT

The total amount of compensation paid to Contractor for full completion of all work required by the Project during the entire term of the Project must not exceed $1,048,007.

DETAILED PROJECT COMPENSATION

Base Bid	$1,019,914
Alternate One	$ 28,093
Total	**$1,048,007**

EXHIBIT C
CONSTRUCTION AGREEMENT

DISPUTE RESOLUTION

1. Disputes.

1.1 Commitment. The parties commit to resolving all disputes promptly, equitably, and in a good-faith, cost-effective manner.

1.2 Application. The provisions of this Exhibit will be used by the parties to resolve all controversies, claims, or disputes ("Dispute") arising out of or related to this Agreement-including Disputes regarding any alleged breaches of this Agreement.

1.3 Initiation. A party may initiate a Dispute by delivery of written notice of the Dispute, including the specifics of the Dispute, to the Representative of the other party as required in this Agreement.

1.4 Informal Resolution. When a Dispute notice is given, the parties will designate a member of their senior management who will be authorized to expeditiously resolve the Dispute.

(A) The parties will provide each other with reasonable access during normal business hours to any and all non-privileged records, information and data pertaining to any Dispute in order to assist in resolving the Dispute as expeditiously and cost effectively as possible;

(B) The parties' senior managers will meet within 10 business days to discuss and attempt to resolve the Dispute promptly, equitably, and in a good faith manner, and

(C) The Senior Managers will agree to subsequent meetings if both parties agree that further meetings are necessary to reach a resolution of the Dispute.

2. Arbitration.

2.1 Rules. If the parties are unable to resolve the Dispute by negotiation within 30 days from the Dispute notice, and unless otherwise informal discussions are extended by the mutual agreement, the Dispute will be decided by binding arbitration in accordance with Construction Industry Rules of the AAA, as amended herein. Although the arbitration will be conducted in accordance with AAA Rules, it will not be administered by the AAA, but will be heard independently.

(A) The parties will exercise best efforts to select an arbitrator within 5 business days after agreement for arbitration. If the parties have not agreed upon an arbitrator within this period, the parties will submit the selection of the arbitrator to one of the principals of the mediation firm of Scott & Skelly, LLC, who will then select the arbitrator. The parties will equally share the fees and costs incurred in the selection of the arbitrator.

(B) The arbitrator selected must be an attorney with at least 15 years experience with commercial construction legal matters in Maricopa County, Arizona, be independent, impartial, and not have engaged in any business for or adverse to either Party for at least 10 years.

2.2 Discovery. The extent and the time set for discovery will be as determined by the arbitrator. Each Party must, however, within ten (10) days of selection of an arbitrator deliver to the other Party copies of all documents in the delivering party's possession that are relevant to the dispute.

2.3 Hearing. The arbitration hearing will be held within 90 days of the appointment of the arbitrator. The arbitration hearing, all proceedings, and all discovery will be conducted in Glendale, Arizona unless otherwise agreed by the parties or required as a result of witness location. Telephonic hearings and other reasonable arrangements may be used to minimize costs.

2.4 Award. At the arbitration hearing, each Party will submit its position to the arbitrator, evidence to support that position, and the exact award sought in this matter with specificity. The arbitrator must select the award sought

by one of the parties as the final judgment and may not independently alter or modify the awards sought by the parties, fashion any remedy, or make any equitable order. The arbitrator has no authority to consider or award punitive damages.

2.5 Final Decision. The Arbitrator's decision should be rendered within 15 days after the arbitration hearing is concluded. This decision will be final and binding on the Parties.

2.6 Costs. The prevailing party may enter the arbitration in any court having jurisdiction in order to convert it to a judgment. The non-prevailing party shall pay all of the prevailing party's arbitration costs and expenses, including reasonable attorney's fees and costs.

3. **Services to Continue Pending Dispute.** Unless otherwise agreed to in writing, Contractor must continue to perform and maintain progress of required services during any Dispute resolution or arbitration proceedings, and City will continue to make payment to Contractor in accordance with this Agreement.

4. **Exceptions.**

4.1 Third Party Claims. City and Contractor are not required to arbitrate any third-party claim, cross-claim, counter claim, or other claim or defense of a third-party who is not obligated by contract to arbitrate disputes with City and Contractor.

4.2 Liens. City or Contractor may commence and prosecute a civil action to contest a lien or stop notice, or enforce any lien or stop notice, but only to the extent the lien or stop notice the Party seeks to enforce is enforceable under Arizona Law, including, without limitation, an action under A.R.S. § 33-420, without the necessity of initiating or exhausting the procedures of this Exhibit.

4.3 Governmental Actions. This Exhibit does not apply to, and must not be construed to require arbitration of, any claims, actions or other process filed or issued by City of Glendale Building Safety Department or any other agency of City acting in its governmental permitting or other regulatory capacity.

C-_____

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED
STATUTORY PERFORMANCE BOND PURSUANT TO TITLE 34,
CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract Amount)

Bond Number 609005907

KNOW ALL MEN BY THESE PRESENTS:

That Caliente Construction, Inc. (hereinafter called the Principal), as Principal, and
* , a corporation organized and existing under the laws of the State of New Hampshire with its principal office in the City of Keene, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Glendale, a municipal corporation, (hereinafter called the Obligee), in the amount of One Million Forty Eight Thousand Seven and No/100 Dollars ($1,048,007.00), for the payment whereof; the said Principal and Surety bind themselves, and their heirs, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, The Principal has entered into a certain written contract with the Obligee, dated the ____ day of , 20___, to construct **PROJECT 141510 - CITY HALL COOLING TOWERS REPLACEMENT**, which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract any extension thereof, with or without notice to the Surety, and during the life of any guaranty required under the contract and shall also perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter, and Article, to the extent as if it were copied at length herein.

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this 5th day of May, 2016.

* The Ohio Casualty Insurance Company

Caliente Construction, Inc.
Principal

By _____
Lorraine Bergman, President/CEO
The Ohio Casualty Insurance Company

Surety David G. Jensen, Attorney-In-Fact Seal

Willis Towers Watson/Willis of Arizona, Inc.
Agency of Record

16220 N. Scottsdale Road, Suite 600
Scottsdale, AZ 85254
Agency Address

Telephone Number: 602-787-6000

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED

STATUTORY PAYMENT BOND PURSUANT TO TITLE 34, CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES

(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS: Bond Number 609005907

That, Caliente Construction, Inc. (hereinafter called the Principal), as Principal, and * , a corporation organized and existing under the laws of the State of New Hampshire with its principal office in the City of Keene, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Glendale, a municipal corporation, (hereinafter called the Obligee), in the amount of ** Dollars ($ 1,048,007.00), for the payment whereof; the said Principal and Surety bind themselves, and their heirs, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, The Principal has entered into a certain written contract with the Obligee, dated the day of _____, 20___, to construct **PROJECT 141510 - CITY HALL COOLING TOWERS REPLACEMENT** which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said Contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond having been required of the said Principal in order to comply with the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, all rights and remedies on this bond shall inure solely to such persons and shall be determined in accordance with the provisions, conditions, and limitations of said Title, Chapter and Article, to the same extent as if they were copied at length herein.

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this 5th day of May, 2016.

* The Ohio Casualty Insurance Company

** One Million Forty Eight Thousand Seven and No/100

Caliente Construction, Inc.
Principal Seal

CALIENTE CONSTRUCTION, INC. CORPORATE SEAL 1991 ARIZONA

By _____
Lorraine Bergman, President/CEO
The Ohio Casualty Insurance Company

Surety David G. Jensen, Attorney-In-Fact Seal

Willis Towers Watson / Willis of Arizona, Inc.
Agency of Record

Agency Address

16220 N. Scottsdale Road, Suite 600
Scottsdale, AZ 85254

Telephone 602-787-6000

THIS POWER OF ATTORNEY IS NOT VALID UNLESS IT IS PRINTED ON RED BACKGROUND.
This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Certificate No. 7127501

American Fire and Casualty Company
The Ohio Casualty Insurance Company
Liberty Mutual Insurance Company
West American Insurance Company

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That American Fire & Casualty Company and The Ohio Casualty Insurance Company are corporations duly organized under the laws of the State of New Hampshire, that Liberty Mutual Insurance Company is a corporation duly organized under the laws of the State of Massachusetts, and West American Insurance Company is a corporation duly organized under the laws of the State of Indiana (herein collectively called the "Companies"), pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Brandy L. Baich; David G. Jensen; Erin Brown; James A. Bracy; Kristin D. Thurber; Terry Crull

all of the city of Scottsdale, state of AZ each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Companies as if they have been duly signed by the president and attested by the secretary of the Companies in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 30th day of September, 2015.

American Fire and Casualty Company
The Ohio Casualty Insurance Company
Liberty Mutual Insurance Company
West American Insurance Company

By: _____
David M. Carey, Assistant Secretary

STATE OF PENNSYLVANIA ss
COUNTY OF MONTGOMERY

On this 30th day of September, 2015, before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of American Fire and Casualty Company, Liberty Mutual Insurance Company, The Ohio Casualty Insurance Company, and West American Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at Plymouth Meeting, Pennsylvania, on the day and year first above written.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Teresa Pastella, Notary Public
Plymouth Twp., Montgomery County
My Commission Expires March 28, 2017
Member, Pennsylvania Association of Notaries

By: _____
Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of American Fire and Casualty Company, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS – Section 12. Power of Attorney. Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII – Execution of Contracts – SECTION 5. Surety Bonds and Undertakings. Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Gregory W. Davenport, the undersigned, Assistant Secretary, of American Fire and Casualty Company, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 5th day of May, 2016.

By: _____
Gregory W. Davenport, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

To confirm the validity of this Power of Attorney call 1-610-832-8240 between 9:00 am and 4:30 pm EST on any business day.

LMS_12873_122013

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 5/4/2016

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
INSURICA / Minard-Ames Insurance Services LLC
4646 E. Van Buren St., #200
Phoenix AZ 85008

CONTACT NAME: Certificates
PHONE (A/C, No, Ext): 602-273-1625 **FAX (A/C, No):** 602-273-0212
E-MAIL ADDRESS: certs@INSURICA.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A: The Cincinnati Insurance Company	10677
INSURER B: Westchester Fire Insurance Co.	10030
INSURER C: The Cincinnati Casualty Company	28665
INSURER D: Hanover Insurance Company	22292
INSURER E: Great American E&S Ins. Co.	37532
INSURER F:	

INSURED
CALICON02C
Caliente Construction, Inc.
485 W. Vaughn Street
Tempe AZ 85283

COVERAGES **CERTIFICATE NUMBER:** 288678400 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR X $5,000 PD Ded GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC [ ] OTHER:	Y	Y	CPP1093935	10/1/2015	10/1/2016	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$1,000,000 $500,000 $10,000 $1,000,000 $2,000,000 $2,000,000 $
A	AUTOMOBILE LIABILITY X ANY AUTO [ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS X HIRED AUTOS [X] NON-OWNED AUTOS	Y	Y	CPA1093935	10/1/2015	10/1/2016	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$1,000,000 $ $ $ $
B	[ ] UMBRELLA LIAB [X] OCCUR X EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [ ] RETENTION $	Y	Y	G27905365001	10/1/2015	10/1/2016	EACH OCCURRENCE AGGREGATE $	$10,000,000 $10,000,000 $
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N If yes, describe under DESCRIPTION OF OPERATIONS below	N/A	Y	WC212800900	10/1/2015	10/1/2016	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
D E	***Builders Risk - see below Professional/*Pollution Liab Self Insd Retention: $25,000			IH4A10982801 PCE190316302	10/1/2015 6/12/2015	10/1/2016 6/12/2016	Builders Risk Limit Prof-Claims Made/Agg Pollution	**$15,000,000 $1M / $2M SEE BELOW

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

**Builders Risk: Temporary Loc/Transit - Limit: $250,000 / Includes Quake/Flood - Limit: $5,000,000 ~ Ded: $25,000. **Builders Risk Sublimits ~ Frame Construction: $5,000,000; Joisted Masonry Construction: $7,500,000; Noncombustible Construction: $15,000,000; All Other Types of Construction: $15,000,000. ***Failure by the insured to report builders risk on a monthly basis may Void coverage. *POLLUTION LIABILITY LIMITS - Includes Mold Coverage: Each Pollution Condition: $5,000,000; Coverage Aggregate Limit: $10,000,000 ~ Self-Insured Retention: $10,000. Certificate Holder is defined as additional insured with respects to the general, auto and excess liability if required or agreed to in a written contract subject to all provisions and limitations of the policy. General Liability coverage is primary and See Attached...

CERTIFICATE HOLDER

City of Glendale
5850 W. Glendale Ave
Glendale AZ 85301

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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AGENCY CUSTOMER ID: CALICON02C

LOC #:

ADDITIONAL REMARKS SCHEDULE

AGENCY	NAMED INSURED
INSURICA / Minard-Ames Insurance Services LLC	Caliente Construction, Inc. 485 W. Vaughn Street Tempe AZ 85283
POLICY NUMBER	
CARRIER / NAIC CODE	EFFECTIVE DATE:

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** CERTIFICATE OF LIABILITY INSURANCE

non-contributory. A Waiver of subrogation in favor of Certificate Holder applies to the general, auto and excess liability and employers liability/workers compensation if required or agreed to in a written contract subject to all provisions and limitation of the policy. Per attached forms: GA233AZ 09/09; GA4316AZ 09/09; AA4171 11/05; GA4094 10/01; AA4172 09/09; WC000313.
City of Glendale Project#141510-City Hall Cooling Towers Replacement

Additional Insured- City of Glendale

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Policy No: CPP1093935

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

CONTRACTORS' COMMERCIAL GENERAL LIABILITY BROADENED ENDORSEMENT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

A. Endorsement - Table of Contents:

Coverage:	Begins on Page:
1. Employee Benefit Liability Coverage	2
2. Unintentional Failure to Disclose Hazards	7
3. Damage to Premises Rented to You	8
4. Supplementary Payments	9
5. Medical Payments	9
6. Voluntary Property Damage (Coverage **a.**) and Care, Custody or Control Liability Coverage (Coverage **b.**)	9
7. 180 Day Coverage for Newly Formed or Acquired Organizations	10
8. Waiver of Subrogation	10
9. Automatic Additional Insured - Specified Relationships:	10
• Managers or Lessors of Premises;	
• Lessor of Leased Equipment;	
• Vendors;	
• State or Political Subdivisions - Permits Relating to Premises;	
• State or Political Subdivisions - Permits; and	
• Contractors' Operations	
10. Broadened Contractual Liability - Work Within 50' of Railroad Property	13
11. Property Damage to Borrowed Equipment	13
12. Employees as Insureds - Specified Health Care Services:	14
• Nurses;	
• Emergency Medical Technicians; and	
• Paramedics	
13. Broadened Notice of Occurrence	14

B. Limits of Insurance:

The Commercial General Liability Limits of Insurance apply to the insurance provided by this endorsement, except as provided below:

1. Employee Benefit Liability Coverage

Each Employee Limit:	$ 1,000,000
Aggregate Limit:	$ 3,000,000
Deductible:	$ 1,000

3. Damage to Premises Rented to You

The lesser of:

a. The Each Occurrence Limit shown in the Declarations; or

b. $500,000 unless otherwise stated $ _____

4. Supplementary Payments

a.	Bail bonds:	$ 1,000
b.	Loss of earnings:	$ 350

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b. Deductible Clause

(1) Our obligation to pay damages on your behalf applies only to the amount of damages for each "occurrence" which are in excess of the deductible amount stated in Section **B. Limits of Insurance**, **6. Voluntary Property Damage and Care, Custody or Control Liability Coverage** of this endorsement. The limits of insurance will not be reduced by the application of such deductible amount.

(2) Condition **2. Duties in the Event of Occurrence, Offense, Claim or Suit**, applies to each claim or "suit" irrespective of the amount.

(3) We may pay any part or all of the deductible amount to effect settlement of any claim or "suit" and, upon notification of the action taken, you shall promptly reimburse us for such part of the deductible amount as has been paid by us.

7. 180 Day Coverage for Newly Formed or Acquired Organizations

SECTION II - WHO IS AN INSURED is amended as follows:

Subparagraph **a.** of Paragraph **4.** is hereby deleted and replaced by the following:

a. Insurance under this provision is afforded only until the 180th day after you acquire or form the organization or the end of the policy period, whichever is earlier;

8. Waiver of Subrogation

SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 9. Transfer of Rights of Recovery Against Others to Us is hereby amended by the addition of the following:

We waive any right of recovery we may have because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a written contract requiring such waiver with that person or organization and included in the "products-completed operations hazard". However, our rights may only be waived prior to the "occurrence" giving rise to the injury or damage for which we make payment under this Coverage Part. The insured must do nothing after a loss to impair our rights. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce those rights.

9. Automatic Additional Insured - Specified Relationships

a. The following is hereby added to **SECTION II - WHO IS AN INSURED**:

(1) Any person or organization described in Paragraph **9.a.(2)** below (hereinafter referred to as additional insured) whom you are required to add as an additional insured under this Coverage Part by reason of:

(a) A written contract or agreement; or

(b) An oral agreement or contract where a certificate of insurance showing that person or organization as an additional insured has been issued,

is an insured, provided:

(a) The written or oral contract or agreement is:

1) Currently in effect or becomes effective during the policy period; and

2) Executed prior to an "occurrence" or offense to which this insurance would apply; and

(b) They are not specifically named as an additional insured under any other provision of, or endorsement added to, this Coverage Part.

(2) Only the following persons or organizations are additional insureds under this endorsement, and insurance coverage provided to such additional insureds is limited as provided herein:

(a) The manager or lessor of a premises leased to you with whom you have agreed per Paragraph **9.a.(1)** above to provide insurance, but only with respect to liability arising out of the ownership, maintenance or use of that part of a premises leased to you, subject to the following additional exclusions:

This insurance does not apply to:

1) Any "occurrence" which takes place after

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you cease to be a tenant in that premises.

2) Structural alterations, new construction or demolition operations performed by or on behalf of such additional insured.

(b) Any person or organization from which you lease equipment with whom you have agreed per Paragraph **9.a.(1)** above to provide insurance. Such person(s) or organization(s) are insureds solely with respect to their liability arising out of the maintenance, operation or use by you of equipment leased to you by such person(s) or organization(s). However, this insurance does not apply to any "occurrence" which takes place after the equipment lease expires.

(c) Any person or organization (referred to below as vendor) with whom you have agreed per Paragraph **9.a.(1)** above to provide insurance, but only with respect to "bodily injury" or "property damage" arising out of "your products" which are distributed or sold in the regular course of the vendor's business, subject to the following additional exclusions:

1) The insurance afforded the vendor does not apply to:

a) "Bodily injury" or "property damage" for which the vendor is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that the vendor would have in the absence of the contract or agreement;

b) Any express warranty unauthorized by you;

c) Any physical or chemical change in the product made intentionally by the vendor;

d) Repackaging, unless unpacked solely for the purpose of inspection, demonstration, testing, or the substitution of parts under instructions from the manufacturer, and then repackaged in the original container;

e) Any failure to make such inspections, adjustments, tests or servicing as the vendor has agreed to make or normally undertakes to make in the usual course of business, in connection with the distribution or sale of the products;

f) Demonstration, installation, servicing or repair operations, except such operations performed at the vendor's premises in connection with the sale of the product;

g) Products which, after distribution or sale by you, have been labeled or relabeled or used as a container, part or ingredient of any other thing or substance by or for the vendor.

2) This insurance does not apply to any insured person or organization:

a) From whom you have acquired such products, or any ingredient, part or container, entering into, ac-

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companying or containing such products; or

b) When liability included within the "products-completed operations hazard" has been excluded under this Coverage Part with respect to such products.

(d) Any state or political subdivision with which you have agreed per Paragraph **9.a.(1)** above to provide insurance, subject to the following additional provision:

This insurance applies only with respect to the following hazards for which the state or political subdivision has issued a permit in connection with premises you own, rent or control and to which this insurance applies:

1) The existence, maintenance, repair, construction, erection, or removal of advertising signs, awnings, canopies, cellar entrances, coal holes, driveways, manholes, marquees, hoist away openings, sidewalk vaults, street banners, or decorations and similar exposures; or

2) The construction, erection, or removal of elevators; or

3) The ownership, maintenance, or use of any elevators covered by this insurance.

(e) Any state or political subdivision with which you have agreed per Paragraph **9.a.(1)** above to provide insurance, subject to the following provisions:

1) This insurance applies only with respect to operations performed by you or on your behalf for which the state or political subdivision has issued a permit.

2) This insurance does not apply to "bodily injury", "property damage" or "personal and advertising injury" arising out of operations performed for the state or political subdivision.

(f) Any person or organization with which you have agreed per Paragraph **9.a.(1)** above to provide insurance, but only with respect to liability caused, in whole or in part, by your ongoing operations performed for that additional insured by you or on your behalf. A person or organization's status as an insured under this provision of this endorsement ends when your operations for that insured are completed.

(3) Any insurance provided to an additional insured designated under Paragraph **9.a.(2)**:

(a) Subparagraphs **(e)** and **(f)** does not apply to "bodily injury" or "property damage" included within the "products-completed operations hazard";

(b) Subparagraphs **(a)**, **(b)**, **(d)** and **(e)** does not apply to "bodily injury", "property damage" or "personal and advertising injury" arising out of the sole negligence or willful misconduct of the additional insured or their agents, "employees" or any other representative of the additional insured; or

(c) Subparagraph **(f)** does not apply to "bodily injury", "property damage" or "personal and advertising injury" arising out of:

1) The rendering of or failure to render any professional services by you or on your behalf, but only with respect to either or both of the following operations:

a) Providing engineering, architectural or surveying services to others; and

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b) Providing or hiring independent professionals to provide engineering, architectural or surveying services in connection with the construction work you perform.

Subject to the final paragraph of this exclusion below, professional services include:

a) Preparing, approving or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; and

b) Supervisory or inspection activities performed as a part of any architectural or engineering activities.

Professional services do not include services within construction means, methods, techniques, sequences and procedures employed by you in connection with construction work you perform.

2) "Your work" for which a consolidated (wrap-up) insurance program has been provided by the prime contractor-project manager or owner of the construction project in which you are involved.

b. Only with regard to insurance provided to an additional insured designated under Paragraph **9.a.(2)** Subparagraph **(f)** above, **SECTION III - LIMITS OF INSURANCE** is amended to include:

The limits applicable to the additional insured are those specified in the written contract or agreement or in the Declarations of this Coverage Part, whichever are less. If no limits are specified in the written contract or agreement, or if there is no written contract or agreement, the limits applicable to the additional insured are those specified in the Declarations of this Coverage Part. The limits of insurance are inclusive of and not in addition to the limits of insurance shown in the Declarations.

c. SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. Other Insurance is hereby amended as follows:

Any insurance provided by this endorsement shall be primary to other insurance available to the additional insured except:

(1) As otherwise provided in **SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. Other Insurance, b. Excess Insurance**; or

(2) For any other valid and collectible insurance available to the additional insured as an additional insured by attachment of an endorsement to another insurance policy that is written on an excess basis. In such case, the coverage provided under this endorsement shall also be excess.

10. Broadened Contractual Liability - Work Within 50' of Railroad Property

It is hereby agreed that Paragraph **f.(1)** of Definition **12.** "Insured contract" (**SECTION V - DEFINITIONS**) is deleted.

11. Property Damage to Borrowed Equipment

a. The following is hereby added to Exclusion **j. Damage to Property** of Paragraph **2., Exclusions** of **SECTION I - COVERAGES, COVERAGE A. BODILY INJURY AND PROPERTY DAMAGE LIABILITY**:

Paragraphs **(3)** and **(4)** of this exclusion do not apply to tools or equipment loaned to you, provided they are not being used to perform operations at the time of loss.

b. With respect to the insurance provided by this section of the endorsement, the following additional provisions apply:

(1) The Limits of insurance shown in the Declarations are replaced by the limits designated in Section **B. Limits of Insurance, 11.** of this endorsement with respect to coverage provided by this endorsement. These limits are inclusive of and not in addition to the limits being replaced. The

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Limits of Insurance shown in Section **B. Limits of Insurance, 11.** of this endorsement fix the most we will pay in any one "occurrence" regardless of the number of:

(a) Insureds;

(b) Claims made or "suits" brought; or

(c) Persons or organizations making claims or bring "suits".

(2) Deductible Clause

(a) Our obligation to pay damages on your behalf applies only to the amount of damages for each "occurrence" which are in excess of the Deductible amount stated in Section **B. Limits of Insurance, 11.** of this endorsement. The limits of insurance will not be reduced by the application of such Deductible amount.

(b) Condition **2. Duties in the Event of Occurrence, Offense, Claim or Suit**, applies to each claim or "suit" irrespective of the amount.

(c) We may pay any part or all of the deductible amount to effect settlement of any claim or "suit" and, upon notification of the action taken, you shall promptly reimburse us for such part of the deductible amount as has been paid by us.

12. Employees as Insureds - Specified Health Care Services

It is hereby agreed that Paragraph **2.a.(1)(d)** of **SECTION II - WHO IS AN INSURED**, does not apply to your "employees" who provide professional health care services on your behalf as duly licensed:

a. Nurses;

b. Emergency Medical Technicians; or

c. Paramedics,

in the jurisdiction where an "occurrence" or offense to which this insurance applies takes place.

13. Broadened Notice of Occurrence

Paragraph **a.** of Condition **2. Duties in the Event of Occurrence, Offense, Claim or Suit (SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS)** is hereby deleted and replaced by the following:

a. You must see to it that we are notified as soon as practicable of an "occurrence" or an offense which may result in a claim. To the extent possible, notice should include:

(1) How, when and where the "occurrence" or offense took place;

(2) The names and addresses of any injured persons and witnesses; and

(3) The nature and location of any injury or damage arising out of the "occurrence" or offense.

This requirement applies only when the "occurrence" or offense is known to an "authorized representative".

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Policy No: CPP1093935

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ARIZONA AUTOMATIC ADDITIONAL INSURED - WHEN REQUIRED IN CONTRACT OR AGREEMENT WITH YOU - COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

A. **SECTION II - WHO IS AN INSURED, 2.** is amended to include:

e. Any person or organization, hereinafter referred to as **Additional Insured:**

(1) Who or which is not specifically named as an additional insured under any other provision of, or endorsement added to, this Coverage Part; and

(2) For whom you are required to add as an additional insured, except any architect, engineer or surveyor, on a completed operations basis on this Coverage Part

under a written contract or written agreement:

(1) But only with respect to liability caused, in whole or in part, by "your work" performed for that additional insured by you or on your behalf; and

(2) If the written contract or written agreement specifies coverage for the additional insured in the "products-completed operation hazard".

With respect to the person(s) or organization(s) referenced in Paragraph **A.2.e.** above, their status as an additional insured under this endorsement will not apply beyond the period of time required in that written construction contract or agreement referred to in Paragraph **A.2.e.** above. If that written construction contract or agreement does not specify a period of time, this coverage will not apply beyond 1 year from the completion of "your work" where the work that caused the "bodily injury" or "property damage" occurred. "Your work" will be deemed completed as specified in Paragraph **a.(2)** of **SECTION V - DEFINITIONS, 19.** "Products-completed operations hazard".

B. With respect to the additional insureds referenced in Paragraph **A.2.e.** above, the following exclusion is added to Paragraph **2. Exclusions** of **SECTION I - COVERAGES, COVERAGE A. BODILY INJURY AND PROPERTY DAMAGE LIABILITY,** this insurance does not apply to "bodily injury" or "property damage" arising out of:

1. The rendering of or failure to render any professional services by you or on your behalf, but only with respect to either or both of the following operations:

a. Providing engineering, architectural or surveying services to others; and

b. Providing or hiring independent professionals to provide engineering, architectural or surveying services in connection with the construction work you perform.

Subject to the final paragraph of this exclusion below, professional services include:

a. Preparing, approving or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders, or drawings and specifications; and

b. Supervisory or inspection activities performed as a part of any architectural or engineering activities.

Professional services do not include services within construction means, methods, techniques, sequences and procedures employed by you in connection with construction work you perform.

2. "Your work" for which a consolidated (wrap-up) insurance program has been provided by the prime contractor / project manager or owner of the construction project in which you are involved.

3. "Bodily injury" or "property damage" arising out of "residential construction".

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C. **SECTION III - LIMITS OF INSURANCE** is amended to include:

The limits of insurance available to the additional insured(s) will not exceed:

1. Those limits specified in the written construction contract or agreement referred to in Paragraph **A.2.e.** above; or

2. The Limits of Insurance specified in the Declarations of this Coverage Part;

whichever are less. If no limits are specified in that written construction contract or agreement, the limits available to the additional insured(s) will not exceed the Limits of Insurance specified in the Declarations of this Coverage Part. The limits of insurance available to the additional insured(s) are inclusive of and not in addition to the Limits of Insurance shown in the Declarations.

D. **SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS** is amended to include the following:

AUTOMATIC ADDITIONAL INSURED PROVISION

The written construction contract or agreement referred to in Paragraph **A.2.e.** above must:

1. Be currently in effect or become effective during the term of this Coverage Part; and

2. Have been executed prior to the "bodily injury" or "property damage" to which this endorsement pertains,

E. **SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. Other Insurance, b. Excess Insurance** is amended to include the following:

1. Where required by the written construction contract or agreement referred to in Paragraph **A.2.e.** above, this insurance is primary and / or noncontributory as respects any other insurance policy issued to the additional insured, and such other insurance policy shall be excess and / or noncontributing, whichever applies, with this insurance.

2. Any insurance provided by this endorsement shall be primary to other insurance available to the additional insured except:

   a. As otherwise provided in **SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. Other Insurance, b. Excess Insurance**; or

   b. When other valid and collectible insurance is available to the additional insured:

      (1) As an additional insured by attachment of an endorsement to another insurance policy; and

      (2) On an excess basis.

      In such case the coverage provided under this endorsement shall also be excess.

F. **SECTION V - DEFINITIONS** is amended to include:

1. "Residential construction" means:

   a. A structure where any of the structure's square foot area is used, or is intended, for the purpose of human habitation and includes, but is not limited to, single-family housing, multi-family housing, apartments, condominiums, townhouses, and similar structures intended for human habitation; and

   b. Common areas and appurtenant structures of those structures listed in Paragraph **1.a.** above.

"Residential construction" does not include:

a. Hospitals or prisons; and

b. Military housing, dormitories, long-term care facilities, hotels or motels, provided there is no individual ownership of units.

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THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED BY CONTRACT

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
GARAGE COVERAGE FORM

This endorsement changes the policy effective on the inception date of the policy unless another date is indicated below.

Endorsement Effective: 10/01/2015	Policy Number: CPA1093935
Named Insured: Caliente Construction, Inc.	
Countersigned by: (Authorized Representative)	

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

SECTION II - LIABILITY COVERAGE, A. Coverage, 1. Who is an Insured is amended to include as an insured any person or organization with which you have agreed in a valid written contract to provide insurance as is afforded by this policy.

This provision is limited to the scope of the valid written contract.

This provision does not apply unless the valid written contract has been executed prior to the "bodily injury" or "property damage".

Policy No: CPP1093935

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

PRIMARY / NONCONTRIBUTORY AMENDMENT OF CONDITIONS FOR DESIGNATED ADDITIONAL INSUREDS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name of Person or Organization (Additional Insured):

ANY PERSON OR ORGANIZATION FOR WHOM YOU ARE REQUIRED IN WRITTEN CONTRACT TO ADD AS AN ADDITIONAL INSURED ON A PRIMARY AND NONCONTRIBUTORY BASIS

With respect to insurance provided the additional insured shown in the Schedule, **SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. Other Insurance** is deleted in its entirety and replaced by the following:

5. Other Insurance

If other valid and collectible insurance is available to the additional insured for a loss we cover under Coverages **A** or **B** of this Coverage Part, our obligations are limited as follows:

a. Primary Insurance

Where required by a written contract, this insurance is primary and noncontributory as respects any other insurance policy issued to the additional insured. Otherwise, **b.** below applies.

b. Excess Insurance

This insurance is excess over any of the other insurance available to the additional insured whether primary, excess, contingent or on any other basis.

When this insurance is excess, we will have no duty under Coverages **A** or **B** to defend any claim or "suit" that any other insurer has a duty to defend. If no other insurer defends, we will undertake to do so, but we will be entitled to the insured's rights against all those other insurers.

When this insurance is excess over any other insurance, we will pay only our share of the amount of the loss, if any, that exceeds the sum of:

(1) The total amount that all such other insurance would pay for the loss in the absence of this insurance; and

(2) The total of all deductible and self-insured amounts under all that other insurance.

We will share the remaining loss, if any, with any other insurance that was not bought specifically to apply in excess of the Limits of Insurance shown in the Declarations of this Coverage Part.

c. Method of Sharing

If all of the other insurance permits contribution by equal shares, we will follow this method also. Under this approach each insurer contributes equal amounts until it has paid its applicable limit of insurance or none of the loss remains, whichever comes first.

If any of the other insurance does not permit contribution by equal shares, we will contribute by limits. Under this method, each insurer's share is based on the ratio of its applicable limit of insurance to the total applicable limits of insurance of all insurers.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

BLANKET WAIVER OF SUBROGATION - AUTO

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM

This endorsement changes the policy effective on the inception date of the policy unless another date is indicated below.

Endorsement Effective: 10/01/2015	Policy Number: CPA1093935
Named Insured: Caliente Construction, Inc.	
Countersigned by: (Authorized Representative)	

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

1. **Blanket Waiver of Subrogation**

   SECTION IV - BUSINESS AUTO CONDITIONS, A. Loss Conditions, 5. Transfer of Rights of Recovery Against Others to Us is amended by the addition of the following:

   We waive any right of recovery we may have against any person or organization because of payments we make for "bodily injury" or "property damage" arising out of the operation of a covered "auto" when you have assumed liability for such "bodily injury" or "property damage" under an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution of the "insured contract".

Policy No: WC212800900

WORKERS COMPENSATION AND EMPLOYERS LIABILITY INSURANCE POLICY

WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

This agreement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

Schedule

BLANKET WAIVER OF SUBROGATION

IF YOU ARE REQUIRED BY A WRITTEN CONTRACT OR AGREEMENT, WHICH IS EXECUTED BEFORE A LOSS, TO WAIVE YOUR RIGHTS OF RECOVERY FROM OTHERS, WE AGREE TO WAIVE OUR RIGHTS OF RECOVERY.

THIS WAIVER OF RIGHTS APPLIES TO ANY PERSON OR ORGANIZATION FOR WHOM THE NAMED INSURED HAS AGREED BY WRITTEN CONTRACT TO FURNISH THIS WAIVER, BUT SHALL NOT BE CONSTRUED TO BE A WAIVER WITH RESPECT TO ANY OTHER OPERATIONS IN WHICH THE INSURED HAS NO CONTRACTUAL INTEREST.

This endorsement changes the policy to which it is attached and is effective on the date issued unless otherwise stated.

(The information below is required only when this endorsement is issued subsequent to preparation of the policy.)

Endorsement Effective Policy No. Endorsement No.

Insured

Premium $ **Incl.**

Insurance Company **CINCINNATI INSURANCE COMPANY**

Countersigned by _____

WC 00 03 13

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CITY OF GLENDALE, ARIZONA
PUBLIC WORKS/ENGINEERING DEPARTMENT

CONTRACTOR'S AFFIDAVIT
REGARDING
SETTLEMENT OF CLAIMS

PROJECT 141510 - CITY HALL COOLING TOWERS REPLACEMENT

To the City of Glendale, Arizona

Gentlemen:

This is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of $_____ , as set out in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above described project. The undersigned further agrees to indemnify and save harmless the City of Glendale against any and all liens, claims of liens, suits, actions, damages, charges, costs, litigation expenses, attorneys' fees and any other and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said installation.

Signed and dated at _____ , this ____ day of _____ , 20___.

_____
Contractor

By _____

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

The foregoing instrument was subscribed and sworn to before me this ___ day of _____, 20 .

_____
Notary Public

My Commission Expires: _____

SUPPLEMENTAL GENERAL CONDITIONS

1. GENERAL: By Ordinance No. 1110 New Series, the City of Glendale adopted the "Uniform Standard Specifications for Public Works Construction," which are sponsored and distributed by the Maricopa Association of Governments. Copies of these documents, with revisions, are on file in the office of the City Engineer of the City of Glendale, and are hereby made a part of these Contract Documents.

Whenever in the Uniform Standard Specifications, the words "The Contracting Agency" are used, the meaning shall be the City of Glendale.

In all cases where ASTM, AASHTO, AWWA, USAG, Federal, City of Phoenix, MAG Specifications, Maricopa County, Arizona State Highway, City of Glendale or other standard specifications are referred to, unless otherwise stated, revisions, supplements or addenda issued on or before the date of this contract, shall prevail. In the event of any conflict between these project specifications and the requirements of the plans, detail drawings, MAG Standard Details and Specifications, these project specifications shall prevail.

2. DEFINITIONS: The following terms, as used in or pertaining to the Contract Documents, are defined as follows:

CITY: The word "City" refers to the City of Glendale, Arizona. The official representative of said City in these proceedings shall be the City Engineer.

CONTRACTOR: The word "Contractor" means the person, firm, or corporation with whom the Contract is made by the City.

MATERIALS: The term "Materials" includes, in addition to materials incorporated in the project, equipment and other material used and/or consumed in the performance of the work.

SUBCONTRACTOR: The word "Subcontractor" includes those having a direct contract with the Contractor and those who furnish material worked to a special design according to the plans and/or specifications for this work, but does not include those who merely furnish materials not so worked.

ENGINEER: The word "Engineer" means a person, firm or corporation duly authorized by the City, to act for the City in staking out the work, inspecting materials and construction, and interpreting plans and specifications.

CONTRACT DOCUMENTS: The words "Contract Documents" mean the Notice to Contractors, Information for Bidders, "Uniform Standard Specifications for Public Works Construction," MAG General Conditions, Supplemental General Conditions, Special Provisions, Supplemental Specifications, Proposal, Contract, Payment Bond, Performance Bond, Certificates of Insurance, Plans and Addenda thereto.

3. PROPOSAL QUANTITIES: It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Proposal, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the proposals offered for the work under this Contract; and the Contractor further agrees that the City will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission, or mis-statement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the specifications and the plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

4. WITHDRAWAL OF PROPOSALS: No proposal shall be withdrawn following the opening and reading of the bids for a period of 50 days from the date of opening without the consent of the contracting agency through the body or agent duly authorized to accept or reject the proposal.

5. LOSSES AND DAMAGES: All loss or damage arising out of the nature of the work to be done or from the action of the elements, or from any unforeseen circumstances in the prosecution of the same, or from any unusual obstructions or difficulties which may be encountered in and/or during the prosecution of the work, or from any casualty whatsoever of every description, shall be sustained and borne by the Contractor at his own cost and expense except as otherwise provided by the contract documents or the laws of the State of Arizona.

6. DUST PREVENTION: The Contractor shall take whatever steps, procedures or means required to prevent abnormal dust conditions due to his construction operations in connection with this contract. The dust control measures shall be maintained at all times during construction of the project, to the satisfaction of the Engineer, in accordance with the requirements of the "Maricopa County Health Department Air Pollution Control Regulations" which have been adopted pursuant to A.R.S. § 36-779.

The Contractor shall be required to obtain the necessary permit from the Maricopa County Air Pollution Control Bureau, 1001 N. Central Ave., Phoenix, Arizona 85004 - telephone (602) 506-6727.

7. EXCESS MATERIAL: Excess material shall be removed from the work site and wasted at a location approved by the Engineer. Broken concrete and asphalt may be delivered to the Glendale Sanitary Landfill located at 115th Avenue and Glendale Avenue. The prevailing regulations and fee schedule will not be waived for work under this project. All materials, to be disposed of at the landfill, shall be weighed and disposed of at the prevailing rate.

8. STOCKPILE OF MATERIALS: The Contractor may place or stockpile materials in the public right-of-way, if approved by the Engineer, provided they do not prevent access to adjacent properties or prevent compliance with traffic regulations.

Traffic shall not be required to travel over stockpiled materials, and proper dust control shall be maintained.

9. REFUSE COLLECTION ACCESS: At any time the project construction shall require the closure or disruption of traffic in any roadway, alley, or refuse collection easement such that normal refuse collection will be interfered with, the Contractor shall, at least 48 hours prior to causing such closure or disruption, make arrangements with the Field Operations Department in order that refuse collection service can be maintained.

10. CLEAN-UP: After all work under this contract is completed, the Contractor shall remove all loose concrete, lumber, wire, reinforcing, debris, and other materials not incorporated in the work, from the site of the work. Clean-up shall include the removal of all excess pointing mortar materials within pipes and removal of over-size rocks and boulders left after finish grading. The contractor shall provide for the legal disposal of all waste products, debris, etc., and shall make necessary arrangements for such disposal.

11. SHOP DRAWINGS: The Contractor shall provide shop drawings as may be necessary for the prosecution of the work as required by the contract documents. The Engineer shall promptly review all shop drawings. The Engineer's approval of any shop drawing shall not release the Contractor from responsibility for deviations from the contract documents. The approval of any shop drawing which substantially deviates from the requirements of the contract documents shall be evidenced by a change order.

When submitted for the Engineer's review, shop drawings shall bear the contractor's certification that he has reviewed, checked, and approved the shop drawings and that they are in conformance with the requirements of the contract documents.

Portions of the work requiring a shop drawing or sample submission shall not begin until the shop drawing or sample submission has been approved by the Engineer. A copy of each approved shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

12. PROTECTION OF FINISHED OR PARTIALLY FINISHED WORK: The Contractor shall properly guard and protect all finished or partially finished work, and shall be responsible for the same until the entire contract is completed and accepted, in writing, by the City. The Contractor shall turn over the entire work in full accordance with the specifications before final settlement shall be made.

13. STATUS OF EMPLOYEES: Contractor shall be responsible for assuring the legal working status of its employees and its subcontractor's employees.

14. LAWS AND REGULATIONS: This Contract shall be governed by and constructed in accordance with the laws of the State of Arizona. The Contractor shall keep himself fully informed of all existing and future City and County Ordinances and Regulations and State and Federal Laws and Occupational Safety and Health Standards (OSHA) in any manner affecting the work herein specified. He shall at all times observe and comply with said Ordinances, Regulations, or Laws.

15. PERMITS: The City has obtained certain required permits which are included in the project specifications, but it will be the duty of the Contractor to determine that all the necessary permits have been obtained. The Contractor shall, at his own expense, obtain all required permits which have not been furnished by the City. A no-fee permit will be issued for work in the City of Glendale right-of-way and easement. (Also see Paragraph 7. Dust Prevention.)

16. ELECTRIC POWER AND WATER: The Contractor shall make his own arrangements for electric power and water. Subject to the convenience of the City, he may be permitted to connect to existing facilities where available, but he shall meter and bear the cost of such power or water. Fire hydrant meters may be obtained from the City of Glendale. Installation and removal of meters should be scheduled through the City's Water Services/Utilities Division at 930-2700. For details and current rates, please visit http://www.glendaleaz.com/CrossConnection/firehydrantmeterprogram.cfm.

17. SURVEY CONTROL POINTS AND MONUMENTS: Existing survey monuments indicated on the plans or found during construction shall be protected by the Contractor, and in the event removal is necessary, removal and replacement shall be performed by permission of the Engineer, under direct supervision of the Engineer or his authorized representative. Survey monuments shall be constructed to conform to the requirements of MAG Specifications, Section 405, and Standard Details.

18. EXISTING UTILITIES: The Contractor is hereby advised that the location of all utilities, as shown on the plans, may not be complete nor exact and the Contractor shall satisfy himself as to the exact location of the utilities by contacting Blue Stake or the utility companies before proceeding with the work. After the underground utilities are located by Blue Stake or the utility company, the contractor shall excavate in a careful and prudent manner to prevent unwillful damage to the underground utilities.

In the event the Contractor or its Subcontractor damages an existing, properly identified underground City of Glendale water or sewer line, the Contractor shall be responsible for the repairs at its expense.

The exact location of all existing underground service utilities, whether or not indicated on the plans, shall be determined by the Contractor at no expense to the City, and he shall conduct his work so as to prevent interruption of service or damage to them.

The Contractor shall protect existing utility services and be responsible for their replacement if damaged by him, or to make necessary adjustment in their location, if required, in order to complete the work for his Contract.

Utility companies and other interested parties have been provided with construction plans and the

construction schedule for this project. The Contractor shall comply with MAG Specifications 105.6 to cooperate with the utility companies.

19. MAINTENANCE OF IRRIGATION FACILITIES: Where irrigation facilities interfere with construction, the Contractor shall remove and replace the affected irrigation facilities to its original condition. Final acceptance of replaced facilities will depend upon final approval of the Engineer.

20. OVERHEAD UTILITY LINES AND POLES: Contractor is advised that when work around overhead lines and poles is required on a project the Contractor is required to coordinate with Utility Companies who own and operate overhead lines and poles. The coordination may include, but not be limited to the following activities: pole bracing, de-energizing of lines, and temporary relocations. Contractor is responsible to contact the applicable Utility Company representative and discuss his proposed construction methods; in order to determine what actions the Utility Company must take and the costs related to those actions. The Contractor shall include these costs in the applicable bid items for this project.

The primary and the backup representatives for this review and cost determinations are as follows:

Arizona Public Service:	Mr. Bobby Garza	602-371-7989
Qwest:	Mr. Ron Floyd	602-630-1932
Salt River Project:	Mr. Tim Rinn	602-236-8694
Salt River Project:	Ms. Mariann Ward	602-236-6389
Cox Communications:	Mr. Ron Pint	623-328-3529
Cox Communications:	Ms. Linda Facio	623-328-3500

21. SOUTHWEST GAS FACILITIES EXPOSED DURING CONSTRUCTION: The Contractor, upon exposing a gas line during construction, shall call SOUTHWEST GAS at 602-271-4277. The Southwest Gas patrolman will respond, usually within an hour, to inspect the line. Minor cuts or abrasions to the pipe coating will be rewrapped and tracer wire will be reconnected at no cost to the City.

22. UNDERGROUND UTILITIES' BEDDING: All water, sewer, storm drain, irrigation and other conduits installed within the City of Glendale shall be bedded from bottom of excavation to one foot above the pipe with granular bedding material meeting the requirements of Section 601.4.6 of MAG Uniform Standard Specifications. The initial bedding under the pipe shall follow City of Glendale Detail G-690.

23. SEWER SERVICE LINES: The Contractor shall be responsible for locating, and protecting from damage during construction, all sewer service lines within the project which are not owned by the City. Contractor will be permitted to review the "as-builts" to assist Contractor in locating the non-City owned sewer service lines. These "as-builts" were prepared, and supplied to the City, by private developers or contractors who installed the non-City owned sewer service lines. Therefore, the City does not guarantee or warranty the accuracy of such "as-builts" and the contractor, as a condition for being allowed to review such "as-builts", hereby agrees to hold the City harmless for any and all damages or other expenses contractor may incur as a result of any inaccuracies or incorrect information in these "as-builts".

24. RIGHTS-OF-WAY: The City will provide rights-of-way and easements for all work specified in this Contract, and the Contractor shall not enter or occupy with man, tools, equipment or materials any private ground outside the property of the City of Glendale, Maricopa County, Arizona, without the consent of the property owner.

25. SUBCONTRACTS: Subcontracts shall be in accordance with, and the Contractor shall be bound by, the following provisions:

All subcontracts shall be subject to the approval of the City.

All subcontracts shall be in writing and shall provide that all work to be performed

thereunder shall be performed in accordance with the terms of the Contract.

Certified copies of any and all subcontracts shall be furnished to the City Engineering Department; however, prices may be omitted.

Subcontracts shall conform to the regulations governing employment of labor.

The subcontracting of any part of the work will in no way relieve the Contractor of his responsibility under the Contract.

26. PRE-CONSTRUCTION CONFERENCE: After completion of the Contract Documents, to include bonds, insurance and signatures, and prior to the commencement of any work on the project, the Engineer will schedule a Pre-Construction Conference. This will be held at the City of Glendale, 5850 West Glendale Avenue, Glendale, Arizona.

The purpose of this Conference is to establish a working relationship between the Contractor, Utility Companies, and the Engineer. The agenda will include critical elements of the construction schedule, procedures for handling shop drawings and other submittals, cost breakdown of major lump sum items, payment application and processing, coordination with the involved utility companies, emergency telephone numbers for all representatives involved in the course of construction, and establishment of the Notice to Proceed date.

Minimum attendance by the Contractor shall be a responsible official of the company/corporation, who is authorized to execute and sign documents on behalf of the company/corporation.

27. OVERTIME:

Regular Work Hours: The work required to be performed by the Plans and Specifications for the Project shall be performed only during regular working hours, unless the City has authorized overtime work in accordance with the procedures set forth below. Regular working hours shall be defined as one 8-1/2 hour shift per day, Monday through Friday, or, upon prior approval of the City, one 10-1/2 hour shift per day on a compressed four day work week during Monday through Friday. Regular working hours shall not include Saturdays, Sundays or City recognized legal holidays.

Authorization and Costs: If the Contractor desires to schedule work for times other than regular work hours (overtime), the Contractor shall make a written request to the City at least two business days prior to the scheduled overtime. The City reserves the right to deny the request to work overtime based on the best interest and needs of the City. If an overtime request is denied, the City may, at its sole discretion, extend the contract time at no additional costs to the City.

In the event the Contractor does perform work overtime, with or without the prior approval of the City, the Contractor shall be responsible to the City for all additional costs that may be incurred by the City as a result of the Contractor's overtime work, including costs for engineering, inspections, testing, surveying and construction administration, all in accordance with MAG Section 108.5. However, the Contractor shall not be responsible for City's costs incurred as a result of overtime work requested by the City or overtime work resulting from an emergency which is not the responsibility of the Contractor or its employees, subcontractors or suppliers. The City's cost will be billed directly to the Contractor or may, at the City's option, be deducted from monies due the Contractor.

28. CONTRACTOR'S CONSTRUCTION SCHEDULE: Concurrently, with the execution of the contract and prior to the pre-construction conference, the Contractor shall submit a preliminary schedule for the Engineer's review and acceptance. The schedule shall be in sufficient detail to allow the Engineer to determine if the proposed schedule will conform to an acceptable program of construction operations, as determined by the contracting agency. Within ten calendar days after the preliminary schedule, described above, has been accepted by the Engineer, the Contractor shall submit a progress schedule, utilizing the critical path method scheduling technique, showing the order in which he proposes to carry out the work, the dates on which he will start each phase of the work, and the contemplated date for completion of each phase. The Contractor shall not be permitted to

commence construction until the schedule complying with this paragraph has been submitted to the City. The Contractor will not be granted any extension to the contract time or compensation for any damages as a result of the City's refusal to allow Contractor to commence construction until the critical path method progress schedule has been submitted and accepted by the Engineer.

The critical path method (CPM) scheduling technique requires a breakdown of the entire work into individual tasks and an analysis of the number of days required to perform each task. The schedule submitted to the City should highlight and identify the critical path for the project. After the work is in progress, the Contractor shall submit supplementary progress schedules, using the critical path method technique, of the progress to date and projection for completion. The supplementary progress schedules shall be submitted with each pay request in accordance with the paragraph, "Payments to Contractors," of these Supplemental General Conditions. The progress schedules shall be subject to the acceptance of the Engineer. In the event the Contractor fails to submit a supplementary progress schedule acceptable to the Engineer, the City may withhold further progress payments to the Contractor until the Contractor submits an acceptable supplementary progress schedule, which is accepted by the Engineer, to the City. Schedule changes requiring an increase in the City's engineering personnel on the project shall not be put into effect until the Engineer has approved such increase and made arrangements for the required additional personnel.

29. CHARACTER OF WORKMEN: None but skilled foremen and workmen shall be employed on work requiring special qualifications. When required by the Engineer, the Contractor shall discharge any person who is, in the opinion of the Engineer, disorderly, dangerous, insubordinate, incompetent, or otherwise objectionable. The Contractor shall keep the City harmless from damages or claims for compensation that may occur in the enforcement of this section of the specifications.

30. HINDRANCES AND DELAYS: Except as otherwise provided herein, no charge shall be made by the Contractor for hindrances or delays from any cause during the progress of the work embraced in this Contract; but such delays, if due to no fault or neglect of the Contractor, shall entitle the Contractor to an extension of time allowed for completing the work, sufficient to compensate for the delay, the amount of the delay to be determined by the Engineer, provided the Contractor shall give said Engineer immediate notice in writing of the cause of such delay.

30.1 Delay: In the event of a delay for which the City is solely responsible, which is unreasonable under the circumstances and which was not within the contemplation of City and Contractor at the time this Contract is executed, City and Contractor shall negotiate, in good faith, a payment by the City to Contractor for the expenses incurred by Contractor as a result of such delay, in accordance with the City of Glendale Engineering Department's POLICY STATEMENT FOR CALCULATING DELAYS AND DAMAGES. This provision shall not be construed to void any provision in the contract which requires notice of delay or provides for liquidated damages. However, if the delay is the result of any act or neglect of a third party, including the architect, engineer or other contractor employed by the City, or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonably foreseeable, unavoidable casualties, or any causes beyond the Contractor's control, the Contractor shall not be entitled to any payments or compensation for expenses incurred as a result of such delay, but the Contract Time shall be extended by Change Order for such reasonable time as the Engineer may determine. No extension or compensation will be granted for any delay which is the result, wholly or partially, of any act or neglect of Contractor or any Subcontractor hired by Contractor.

31. LIQUIDATED DAMAGES:

31.1 Should the contractor fail to substantially complete the work under this contract within the time for completion stated in the paragraph "Time of Completion," in the Information for Bidders, then the contractor shall pay the City of Glendale, Arizona, liquidated damages, pursuant to the provisions of Section 108.9, Standard Specifications for Public Works Construction, Maricopa Association of Governments, until the work is substantially complete.

31.2 Should the contractor fail to fully and finally complete the work under this contract within the time for completion set forth in the paragraph "Time of Completion," in the Information for Bidders,

even though the contractor has achieved substantial completion of the work within such time, then the contractor shall pay the City of Glendale, liquidated damages (pursuant to the provisions of Section 108.9, Standard Specifications for Public Works Construction, Maricopa Association of Governments), in an amount equal to 100% of the applicable liquidated damage rate set forth in MAG Section 108.9 for each and every calendar day of delay until the work is fully and finally complete and accepted.

31.3 The date of substantial completion shall be the date when the work is sufficiently complete, in accordance with the contract documents, so the owner can fully occupy and utilize the work or designated portion thereof for the use for which it is intended, with all the project's parts and systems operable as required by the contract documents and all the work is complete, accessible, operable, and usable by the owner for its intended purpose(s), and all parts, systems and sitework are 100% complete and cleaned for the owner's use. Only incidental corrective work and final cleaning (if required), beyond cleaning needed for the owner's full use, may remain for final completion.

31.4 Full and final completion shall be that date when all work under the project, including incidental corrective work under punch list and final cleaning, has been completed and the entire project is accepted by the owner.

32. PAYMENTS TO CONTRACTOR: The measurements of quantities and the payments to the Contractor shall be in accordance with MAG Uniform Standard Specifications for Public Works Construction, Part 100 - General Conditions, Section 109 - Measurements and Payments.

Payments will be made on the basis of itemized, monthly statements prepared by the City and signed by the Contractor. The Contractor shall submit an itemized, duly certified and approved estimate for work completed through the last day of the preceding month in accordance with MAG Specifications, as amended by these Supplemental General Conditions. Upon approval of the pay estimate, the City will mail the check directly to the Contractor.

The pay estimate shall be accompanied by an updated progress schedule as required by these Supplemental General Conditions and a cash flow report when required by the Special Provisions. Approval of progress payments shall be conditional upon submittal of progress schedules and cash flow reports, when required, which are acceptable to the Engineer.

Upon 100% completion and acceptance of the project, and with the request for final payment, the Contractor shall complete and submit the "Contractor's Affidavit Regarding Settlement of Claims" form which is included in these specifications. Before final payment and release of retention, Contractor must arrange for its Surety to provide the City with a fully executed AIA Consent of Surety form. To avoid delays in the final payment, the Surety may send the Consent of Surety directly to the City via fax at (623) 915-2861, and mail the original to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona 85301. Should any ambiguity arise between the Contract and these Conditions, the provisions of the Contract shall prevail.

33. WARRANTY: This project shall have a 2 year warranty. The warranty period shall begin upon final acceptance of the work by the City of Glendale.

END OF SUPPLEMENTAL GENERAL CONDITIONS

SPECIAL PROVISIONS

1. SCOPE OF WORK: Furnish and install three (3) cooling towers on new structural platform as per plans and specifications. After install, contractor shall remove existing cooling towers and replace hardscape area as proposed in contract documents. ALTERNATE #1: Furnish and install six (6) circulating pumps as per plans and specifications.

2. DEFINITIONS:

A. Section: Reference to a Section on the plans or in these Specifications shall mean a Section of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments (MAG), latest revision. The provisions of MAG Uniform Standard Specifications and Details for Public Works Construction, which are not altered or modified by the drawings or by these Special Provisions or by any subsequently issued Addendum, shall apply to the contract even though the Contractor's attention is not specifically drawn to such provisions.

B. Standard Detail: Reference to a MAG Standard Detail (MAG S.D.) on the plans or in these specifications shall mean a standard detail drawing in the latest revision of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments. City of Glendale Standard Detail (C.O.G. S.D.) shall mean a standard detail drawing in the City of Glendale's Engineering Design and Construction Standards, latest revision. City of Phoenix Standard Detail (C.O.P. S.D.) shall mean a standard detail drawing in the Phoenix Supplemental Standard Details for Public Works Construction, latest revision.

3. SUSPENSION OF WORK: The Engineer reserves the right to suspend the work wholly or in part if deemed necessary for the best interest of the City. This suspension will be without compensation to the Contractor, other than to adjust the contract time in accordance with MAG Section 108.

4. COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS: In all instances wherein the item and/or specifications require installation or construction in accordance with either manufacturer's or supplier's recommendations and/or instructions, said recommendations and/or instructions shall be submitted with the applicable portions clearly marked for approval prior to the commencement of work on that item or portion of the contract.

5. TRAFFIC REGULATIONS:

5.1 All traffic affected by this construction shall be regulated in accordance with the City of Phoenix "Traffic Barricade Manual," the "Manual of Uniform Traffic Control Devices" and these Special Provisions. The following traffic restrictions are minimum requirements throughout the construction period:

5.1.1 All references in the City of Phoenix "Traffic Barricade Manual" and the "Manual of Uniform Traffic Control Devices" to "arterial" and/or "collector" streets shall mean "arterial and/or major arterial" streets and are referred to as "major" streets in the following sections.

5.1.2 A minimum of two travel lanes (one for each direction) shall be maintained open to traffic at all times on all major streets. All work that enters or crosses a major street must be done at times other than 6:00 a.m. to 8:30 a.m., and 4:00 p.m. to 6:00 p.m. unless approved by the Transportation Director or Designee.

5.1.3 A travel lane shall be defined as ten (10) feet of roadway not obstructed by traffic control devices with a safe motor vehicle operating speed of twenty-five (25) miles per hour.

5.1.4 A travel lane will not be considered as open to traffic until it has been graded reasonably smooth and is paved with a minimum of two (2) inches of asphalt. This shall be considered temporary pavement and shall be removed completely before proceeding with

final surfacing.

5.1.5 The Contractor shall provide and maintain all required and requested traffic control devices to protect and guide traffic for all work in the construction area.

5.1.6 Intersection area shall be defined as all of the area within the right-of-way of intersecting streets, plus two-hundred fifty (250) feet beyond the center of the intersected streets on all legs of the intersection.

5.1.7 The Contractor shall maintain all existing traffic signs erect, clean and in full view of the intended traffic at all times. Street name signs at major street intersections shall be maintained erect at all times. If any signs interfere with construction, the Contractor shall notify the Transportation Department at least 48 hours in advance before covering or removing said signage. The Contractor shall be responsible for reinstalling all signs removed or covered and verifying they are correctly placed. The Transportation Department will inspect all signage prior to completion of the project.

5.1.8 Local access to all properties on the subject project shall be maintained at all possible times in the form of a safe and reasonable direct route to at least one of the above defined major streets. Whenever local access cannot be maintained, the Contractor shall notify the affected property owner or user and the Engineer at least Seventy-Two (72) hours in advance.

5.1.9 The Contractor shall be required to provide a uniformed off-duty City of Glendale police officer to assist with traffic control whenever traffic in any one direction is restricted to one lane at a signalized major intersection or at other locations if it should become necessary in the opinion of the Transportation Director or Designee. If the Contractor chooses to use a police officer at other locations during peak traffic hours or to assist with his other traffic control operations, the cost shall be included in the lump sum for "Traffic Control" and not paid out of the hours allowed for "Off Duty Glendale Police Officer." All requests for off-duty officers will be made through the Glendale Police Department, Off-Duty Work Administrator. The Contractor must provide evidence of workmen's compensation coverage before any officer will be permitted to work.

Measurement for payment of the uniformed off-duty Glendale police officer hours will be made by the actual number of man-hours used for traffic control at signalized major intersections or as approved by the Engineer. Because the quantity of hours is dependent on the Contractors schedule of activities, the unit price bid for this item will be administered as a contingency bid item and any adjustment in hours will not be subject to the 20 percent limitation.

Payment for the off-duty Glendale police officer will be made at the contract unit price bid per hour for OFF DUTY GLENDALE POLICE OFFICER and shall include the net hourly rate of $35.00 per police officer with a three (3) hour minimum. The net hourly rate shall be increased to include withholding for Federal, State, FICA, Medicare, Workmen's Compensation insurance and any payroll administrative costs.

5.1.10 The Contractor shall prepare a traffic control plan for the project and submit it to the City Transportation Director or Designee for review and approval at least fifteen (15) working days prior to the start of construction. The traffic control plan must be submitted through the City of Glendale on-Line Traffic Control Plan application process at www.glendaleaz.com/transportation/TrafficControlForm.cfm. The traffic control plan shall include message boards installed a minimum of seven (7) working days prior to restrictions when requested by the Transportation Director or Designee, additional public notification shall be required for major restrictions that impact adjacent stakeholders. Any changes to the traffic control plan during construction shall be submitted to the City Transportation Director or Designee for approval at least seventy-two (72) hours before implementation.

Payment for this item shall be made at the contract lump sum price for TRAFFIC CONTROL.

5.1.11 It is the City's desire to maintain one lane of traffic in each direction on minor streets whenever possible. Should it become imperative for the Contractor to close off a portion of any minor street or reduce the travel way to a single lane, he/she must obtain approval from the City Transportation Director or Designee Seventy-Two (72) hours prior to implementing a traffic control change. He/she must provide all the necessary signs to detour traffic and/or flag person to control traffic for a single lane. The maximum amount of time that the street may be closed is from 9:00 a.m. until 4:00 p.m.

5.1.12 Flagger Requirements: All flaggers shall be properly trained and certified by a recognized source, such as the American Traffic Safety Services Association (ATSSA) or National Safety Council, and shall carry with them at all times proof that training and certification requirements have been completed within the last two years.

6. ENERGIZED AERIAL ELECTRICAL POWER LINES: The utility company maintains energized aerial electrical power lines in the immediate vicinity of this project. Do not consider these lines to be insulated. Construction personnel working in proximity to these lines are exposed to an extreme hazard from electrical shock. Contractors, their employees, and all other construction personnel working on this project must be warned of the danger and instructed to take adequate protective measures, including maintaining a minimum ten (10) feet clearance between the lines and all construction equipment and personnel. (See: OSHA Standard 1926.550(a)15.) As an additional safety precaution, Contractors should also be instructed to call the utility company to arrange, if possible, to have these lines de-energized or relocated when the work reaches their immediate vicinity. The cost of such temporary arrangements would be borne by the Contractor. The utility company can often respond to such requests if two days advance notice is given, but some situations may require up to sixty (60) days lead time for relocation or other arrangements.

7. CONCRETE GUTTER WATER TESTING: The MAG Uniform Standard Specifications, Section 340.3, CONSTRUCTION METHODS, shall be modified as follows: The 1/2 inch referenced in Paragraph 16 beginning, "When required by the Engineer, gutter having a slope of 0.8 foot...," shall be changed to 1/4 inch.

8. RECORD DRAWINGS: The Contractor shall maintain one set of contract drawings with all changes, deviations, additions and deletions clearly marked thereon. Upon completion of the work, this set of drawings, shall be marked "RECORD DRAWINGS," dated, and delivered to the Engineer prior to approval of the Contractor's final payment request.

9. SOILS REPORT: The boring logs and soils report for this project are available for review at the City Engineering Office upon request. The boring logs and soils report are provided only as a courtesy. The logs and soils reports are not incorporated into, or part of, the contract and the City of Glendale makes no warranties, express or implied, as to the accuracy of the information contained therein. The Contractor should not rely on the information contained therein and should perform its own investigation as to the subsurface conditions of the project. The logs and soils reports are not intended, nor should they be relied upon by the Contractor as, a representation of the true soil conditions of the project. If there is a conflict between this provision and any other provision of the contract documents, this provision will prevail. The Contractor will accomplish the project under whatever condition he finds at the contract price.

10. CASH FLOW REPORT: The Contractor shall prepare a Cash Flow Report for projected monthly project cash flow on a City provided form and submit it for approval prior to issuance of the Notice to Proceed. The accumulation of monthly pay estimate costs shall be plotted versus time in accordance with the proposed construction schedule. After approval, the Contractor shall submit an updated Cash Flow Report prior to the receipt of each Progress Payment. Each updated Cash Flow Report shall reflect the Contractor's actual monthly payment versus the actual elapsed contract time.

At the City's request, if the projected quarterly project cash flow varies by more than ten percent of the total contract price, the Contractor shall prepare a revised Cash Flow Report. Each revised Cash Flow

Report is subject to approval by the City prior to issuance of the progress payment.

Revisions to the report resulting from Contractor initiated delays or work schedule changes shall be at no cost to the City. Any revisions required by City initiated delays or changes to the work shall be paid as an integral part of the approved Change Order.

11. CONSTRUCTION SIGN: The project type to be indicated on the sign shall be 141510 - CITY HALL COOLING TOWERS REPLACEMENT . See "Construction Sign Detail."

12. ALLOWANCE FOR CONSTRUCTION CONTINGENCIES: Bid schedule includes a lump sum contingency allowance. This allowance is at all times the property of the City and is for the sole purpose of reimbursing Contractor for any unforeseen work not apparent at the time of bidding or additional work requested by the CITY OF GLENDALE.

No work anticipated for reimbursement under this Bid Item shall be initiated by Contractor until Contractor, City of Glendale Representative and City of Glendale agree on the scope and cost to perform the additional work. The Contractor shall prepare and submit to City of Glendale Representative a cost itemization and summary for the additional work. City of Glendale Representative and City of Glendale shall review and approve prior to Contractor proceeding with any additional work. Any portion of the stated sum not expended remains the property of the City of Glendale.

Work under this section shall consist of any additional work identified by the owner and contractor due to construction activity. All work under this item shall be itemized as per MAG requirements and deducted from the set amount of $75,000. All work under this section shall include but is not limited to all necessary materials, tools, layout, survey and labor required to complete each task.

Measurement and payment for this item shall be made on an individual basis per task and as described above. Limit for this item is set at $75,000 on the bid form, under line item ALLOWANCE FOR CONSTRUCTION CONTINGENCY.

END OF SPECIAL PROVISIONS

Project Life Cycle Cash Flow Schedule

Project No.: _____ Date: _____

Project Name: _____

Company Name:

Project Start Date: _____ Project Completion Date _____

Original ☐ Updated ☐ Revised ☐

		Estimated		Actual	
Qtr.	Fiscal Yr.	Amount	Accum.	Amount	Accum.
1st	07/11 - 09/11				
2nd	10/11 - 12/11				
3rd	01/12 - 03-12				
4th	04/12 - 06/12				
1st	07/12 - 09/12				
2nd	10/12 - 12/12				
3rd	01/13 - 03/13				
4th	04/13 - 06/13				
1st	07/13 - 09/13				
2nd	10/13 - 12/13				
3rd	01/14 - 03/14				
4th	04/14 - 06/14				
1st	07/14 - 0914				
2nd	10/14 - 12/14				
3rd	01/15 - 03/15				
4th	04/15 06/15				
1st	07/15 - 09/15				
2nd	10/15 - 12/15				
3rd	01/16- 03/16				
4th	04/16- 06/16				
	Totals	$ -	$ -	$ -	$ -

* COG's fiscal year is July 1, (current year) through June 30, (following year)

For Engineering Use Only:

Account No: _____ PO No. _____

CONSTRUCTION SIGN DETAIL

CONSTRUCTION SIGNS ARE TO BE IN PLACE BEFORE PHYSICAL CONSTRUCTION BEGINS

SIGNS SHALL BE MADE OF 3/4" AC EXTERIOR PLYWOOD OR OTHER MATERIAL APPROVED BY THE ENGINEER

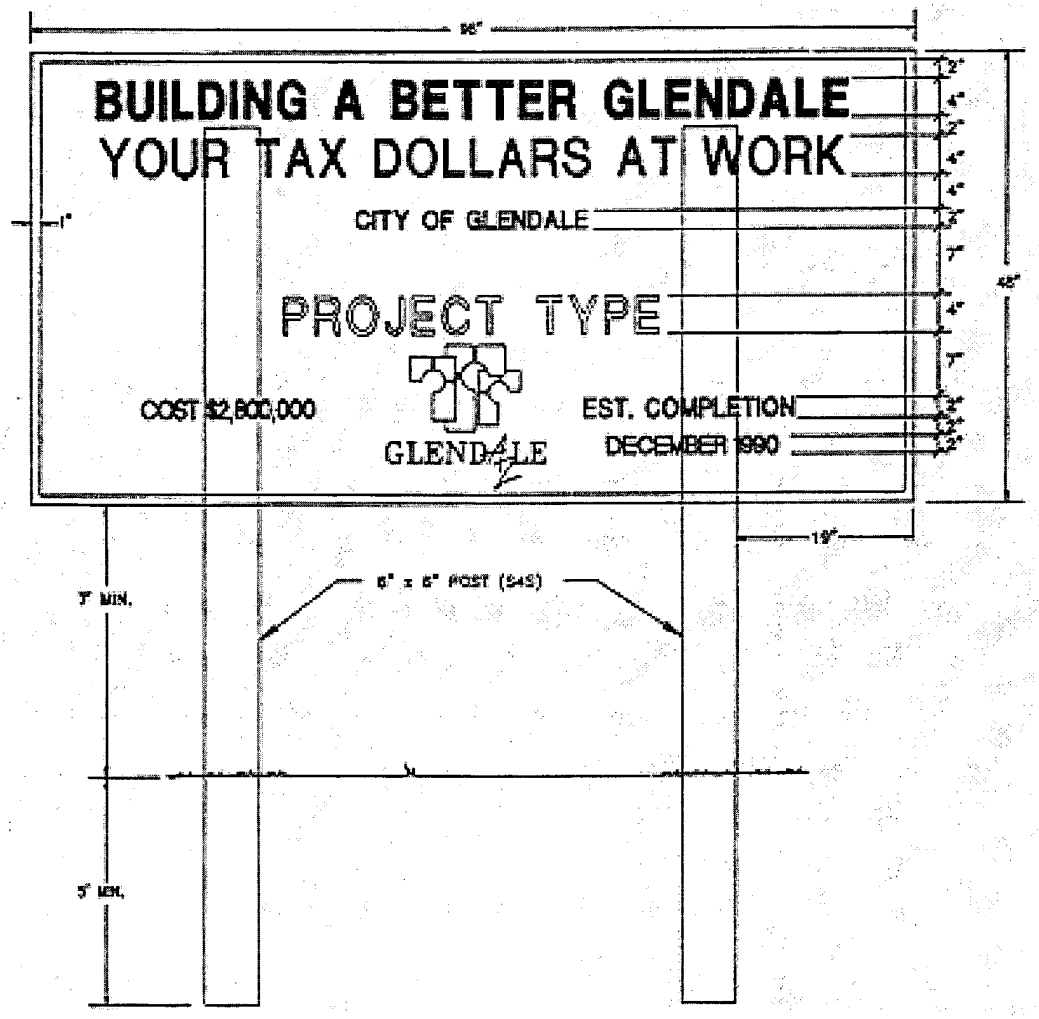
BACKGROUND TO BE PAINTED WHITE WITH STENCIL BLACK LETTERS, NUMERALS AND BORDER.

POSTS SHALL BE PAINTED WHITE. ALL MOUNTING HARDWARE TO BE RUST PROOF MATERIAL

SIGNS SHALL BE SO PLACED THAT THEY WILL NOT OBSCURE OR DETRACT FROM OTHER SIGNING.

CONTRACTOR TO FILL IN THE PROJECT TYPE, COMPLETION DATE, AND COST AS DIRECTED.

THE 12" X 13" TWO COLOR GLENDALE LOGO IS AVAILABLE BY CONTACTING THE CITY OF GLENDALE ENGINEERING DEPT. AT 623-930-3630. COST $18.00



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SECTION 01 1000

SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Miscellaneous provisions.

1.02 PROJECT INFORMATION

A. Project Identification:
1. Project Location: 5850 West Glendale Avenue, Glendale, AZ 85301.

B. Owner: City of Glendale, 5850 West Glendale Avenue, Suite 315, Glendale, AZ 85301.
1. Owner's Representative: Bill Passmore, (623) 930-3630.

C. Architect: Arrington Watkins, LLC., David Watkins, (602) 279-4373.

D. Contractor: TBD

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents..

B. Type of Contract.
1. Project will be constructed under a single prime contract.

1.04 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.05 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72hours in advance of activities that will affect Owner's operations.

1.06 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination drawings.
   2. Requests for Information (RFIs).
   3. Project Web site.
   4. Project meetings.

1.02 DEFINITIONS

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

1.03 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

1.04 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.05 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.06 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Form found at the end of this Section, or provided by Contractor, acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect] after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.07 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.

h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Preparation of record documents.
l. Use of the premises and existing building.
m. Work restrictions.
n. Working hours.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Procedures for moisture and mold control.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.
v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility problems.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.

v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DOCUMENT 01 3100

REQUEST FOR INTERPRETATION FORM

Project: _____ R.F.I Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

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 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Construction schedule updating reports.
   3. Daily construction reports.
   4. Site condition reports.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.03 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at regularly scheduled site meetings.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.04 COORDINATION

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

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in the Technical Specifications. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work.

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

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Installation.
   h. Work by Owner that may affect or be affected by Contractor's activities.
   i. Testing and commissioning.
   j. Punch list and final completion.
   k. Activities occurring following final completion.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

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

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.03 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.

16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of **five** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 CONFLICTING REQUIREMENTS

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

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.04 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
   2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

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

1.05 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

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

1.06 QUALITY ASSURANCE

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

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

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

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

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

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      d. When testing is complete, remove test specimens, assemblies; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow **seven** days for initial review and each re-review of each mockup.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups when directed unless otherwise indicated.

1.07 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

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

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner[, as indicated in Statement of Special Inspections attached to this Section], and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.
7.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

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

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

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."

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

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

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.01 DEFINITIONS

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

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

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.03 ABBREVIATIONS AND ACRONYMS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

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

1.02 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

1.03 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified by the Project Manager.
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in the Technical Specifications. Show compliance with requirements.

1.04 QUALITY ASSURANCE

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

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.06 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   4. Manufacturers:
      a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that

complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in the Technical Specifications for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.
6. Payment will be made for changes to building design, including A/E design, detailing, and construction costs by the substitution.
7. Coordinate, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

B. Consideration shall be given to materials that will reduce vandalism and graffiti.

C. Consideration shall be given to use of recycled products and use of materials which will minimize dumping.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 01 1000 "Summary" for limits on use of Project site.
   2. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.02 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

B. Certified Surveys: Submit two copies signed by land surveyor.

C. Final Property Survey: Submit 2 copies showing the Work performed and record survey data.

1.03 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as

intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site-work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located

and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements"

3.09 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

1.04 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.05 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator.

1.06 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination."

1.07 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:
1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
1. Pulverize concrete to maximum 1-1/2-inch size.

B. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
1. Pulverize masonry to maximum 1-1/2-inch size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

G. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

H. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

I. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

K. Conduit: Reduce conduit to straight lengths and store by type and size.

3.05 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

1.02 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to "Payment Procedures" in the Technical Specifications.
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Submit list of incomplete items in the following format:
      a. MS Excel electronic file. Architect will return annotated copy.
      b. PDF electronic file. Architect will return annotated copy.
      c. Three paper copies unless otherwise indicated. Architect, will return two copies.

1.08 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Names and contact information for Subcontractors, major suppliers list with company's names, addresses and telephone numbers.
11. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Warranties and certifications.

F. Affidavit from general and subcontractors on use of asbestos free materials.

G. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size. Electronic copy of documents on CD and/or DVD.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

H. List of Extra Materials supplied to Owner, signed by Owner'

2.02 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.03 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

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

2.04 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.
   2. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit one paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit three paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
         3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.
c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Format: DWG, Version 2012 or newer, Microsoft Windows operating system.
3. Format: Annotated PDF electronic file.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Architect for resolution.
6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of structure.
   2. Demolition and removal of selected site elements.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 PRE-DEMOLITION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Pre-demolition Photographs or Video: Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.05 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.07 FIELD CONDITIONS

A. Conduct selective demolition so Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.08 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

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

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

B. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.06 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Mix designs shall be submitted on the mix design submittal form included at the end of this Section. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material certificates.

C. Material test reports.

D. Floor surface flatness and levelness measurements.

1.04 QUALITY ASSURANCE

A. Concrete Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Dry-Shake Floor Hardener Installer: List of 5 projects of similar size installed in the prior 5 years complete with contact information.

C. Liquid Densifier/Sealer Installer: Manufacturer approved contractor shall have completed 5 projects of similar size within the prior 5 years and shall submit current certificate of approval or letter of approval issued by Liquid Densifier/Dealer manufacturer.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 306.1, "Standard Specification for Cold Weather Concreting." {Note: Called out in 3.09 F. and 3.13 A.}
4. ACI 308.1, "Standard Specification for Curing Concrete." {Note: Called out in 3.13 E.}
5. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
6. ACI 347, "Guide to Formwork for Concrete." {Note: Called out in 3.1 C.}

H. AASHTO Publication:
1. AASHTO T318, "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying."

I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

J. Pre-installation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Schedule pre-installation conference at least 7 days prior to Work and provide written agenda to all attendees at least 7 days before conference. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. 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.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Products:
   a. Euclid Chemical Company (The): Euco Super Slip.
   b. Euclid Chemical Company (The); Form-Eze Natural.

c. US Mix Products; EZKote Green.

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.
2. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

E. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Construction Joint Slab on Ground Plate Dowels: Plate material shall be 1/4" by 4-1/2" square, ASTM A36 steel and shall be Diamond Dowel System, by PNA Construction Technologies. Locate plate dowels at construction joints. Do not shear plates. Remove burrs at edges of plates

D. Contraction Joint Protection: Load plate shall be smooth steel plate bars, ASTM A36, and shall be Load Plate Basket or PD^3 Basket by PNA Construction Technologies. Locate Load Plate Baskets at contraction joints so noted on the plans. Do not shear. Remove burrs.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type II, gray. Supplement with the following:
a. Fly Ash: ASTM C 618, Class F or C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.
1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
a. Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large top size aggregates (1-1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.
1. Products:
a. Euclid Chemical Company (The); Air Mix or AEA-92 Series.
b. Grace Construction Products; Darex or Daravair series.
c. BASF; MB-VR or MB-A

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Provide all admixtures from same manufacturer to ensure compatibility.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
a. Products:
1) Euclid Chemical Company (The); Eucon Series.
2) BASF; Pozzolith Series.
3) WR Grace; WRDA Hycol.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
a. Products:
1) Euclid Chemical Company (The); Eucon Retarder Series.
2) BASF; Pozzolith Series.
3) WR Grace; Daratard Series.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
a. Products:
1) Euclid Chemical Company (The);Eucon Retarder Series.
2) BASF; Pozzolith Series.
3) WR Grace; Daratard Series.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
a. Products:
1) Euclid Chemical Company (The); Eucon 37 or Plastol Series.
2) BASF; Rheobuild 1000 or Glenium Series.
3) WR Grace; Daracem or Adva Series.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
a. Products:
1) Euclid Chemical Company (The); Eucon 537 or Plastol Series.
2) BASF; Glenium Series.

3) WR Grace; Daracem or Adva series.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
   a. Products:
      1) Euclid Chemical Company (The); Eucon 537.
      2) BASF; Rheobuild Series.
      3) WR Grace; Daracem Series.

2.06 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.

2.07 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.08 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.09 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.12 FLOOR AND SLAB TREATMENTS

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Maximent.
      b. Dayton Superior Corporation; Quartz Tuff.
      c. Euclid Chemical Company (The), an RPM company; Surflex.
      d. L&M Construction Chemicals, Inc.; Quartzplate FF.

2.13 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Curecrete Distribution Inc.; Ashford Formula.
      b. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      c. Euclid Chemical Company (The), Eucosil.
      d. L&M Construction Chemicals, Inc.; Seal Hard.
      e. Meadows, W. R., Inc.; LIQUI-HARD.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Advanced Floor Products; Retro-Plate 99.
b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-) wide joints into

concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

D. Hot-Weather Placement: Comply with ACI 301.
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. Use evaporation retarder when high ambient and concrete temperatures, low humidity, and wind will cause rapid moisture loss from surface of plastic concrete.

3.06 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.07 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

CONCRETE MIX DESIGN SUBMITTAL FORM

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength (Class): _____

Use (describe): _____

Design Mix Information

	Please check one
Based on Standard Deviation Analysis	
Trial Mix Test Data	

Design Characteristics:

Density		pcf
Strength		psi (28 day)
Air		% specified

MATERIALS	***Type/ Source***	***Specific Gravity***	***Weight/lb.***	***Absolute Vol. cu.ft.***
Cement				
Fly Ash				
Slag				
Coarse Aggregate				
Fine Aggregate				
Water				
Air				
Other				
		TOTAL		27.0 cu. ft.

* Water/Cementitious Ratio (lbs. water/lbs. cement) = _____%

END OF SECTION

SECTION 04 2200

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Concrete masonry units (CMU's).
2. Steel reinforcing bars.

1.02 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement. Show elevations of reinforced walls.

C. Samples: For each type and color of exposed masonry unit and colored mortar.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.05 QUALITY ASSURANCE

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.06 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

C. Scaffolding, runways and ladders required for work under this Section shall be provided by masonry contractor, and shall be heavy trades type substantially built and in compliance with State labor laws, safety codes and other regulatory agencies as applicable to this project.

D. Store units off the ground in a dry location, covered and protected from absorbing moisture.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

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

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
2. Density Classification: Medium weight.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.
1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

G. Water: Potable.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Mill galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Provide in lengths of not less than 10 feet.

2.05 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

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

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.07 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. As indicated in General Structural Notes.

D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout with slump indicated in General Structural Notes.

PART 3 - EXECUTION

3.01 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.

3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.02 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.03 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.04 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement as indicated on Drawings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.05 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

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

END OF SECTION

SECTION 04 7200

CAST STONE MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Cast stone wall caps and moldings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and finishes.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association, or the Precast/Pre-stressed Concrete Institute for Group A, Category AT.

PART 2 - PRODUCTS

2.01 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
2. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
4. Provide drips on projecting elements unless otherwise indicated.

B. Cure units as follows:
1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than six days at mean daily temperature of 60 deg F or above.
c. No fewer than seven days at mean daily temperature of 50 deg F or above.
d. No fewer than eight days at mean daily temperature of 45 deg F or above.

C. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

D. Colors and Textures: As selected by Architect from manufacturer's full range.

2.02 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 or steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

B. Dowels: 1/2-inch- diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 or steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner complying with requirements in Section 04 2000 "Unit Masonry," and expressly approved for intended use by cast stone manufacturer and cleaner manufacturer.

2.03 MORTAR

A. Comply with requirements in Section 04 2000 "Unit Masonry" for mortar materials and mixes.
1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

2.04 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.
1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.01 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 04 2000 "Unit Masonry."

B. Set units in full bed of mortar with full head joints unless otherwise indicated.
1. Fill dowel holes and anchor slots with mortar.
2. Fill collar joints solid as units are set.
3. Build concealed flashing into mortar joints as units are set.
4. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
5. Keep joints at shelf angles open to receive sealant.

C. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

D. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
1. Keep joints free of mortar and other rigid materials.
2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 9200 "Joint Sealants."

3.02 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.03 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.
1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone to comply with requirements in Section 04 2000 "Unit Masonry."

END OF SECTION

SECTION 05 7030

SKATEBOARD DETERRENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Skateboard deterrents.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details.
1. Indicate materials, finishes, fasteners, anchorages, and accessory items.

C. Samples: For each type of exposed finish.

PART 2 - PRODUCTS

2.01 STAINLESS STEEL

A. Skateboard Deterrent: Ball and Stud design:
1. Grinderminder manufactured by Grind to a Halt.
2. Brushed Finish

PART 3 - EXECUTION

3.01 EXECUTION

A. Installation:
1. Drill 1/2" diameter hole approximately 1-3/4" deep at 60 degree angle into the concrete cap.
2. Drill at least 1-1/2" deep, starting about ½" in from the edge of the concrete cap.
3. Clear debris from the drilled hole with compressed air works
4. Place one piece of shim stock in the drilled hole on the side of the hole.
5. Fill the hole approximately one-third full with epoxy.
6. Insert the GrinderMinder into the hole and drive it into the hole using a rubber mallet. The ball end of the GrinderMinder should now be located on the top edge of the landscape feature
7. Carefully wipe excess epoxy from the stone and GrinderMinder immediately
8. Repeat this process for each GrinderMinder to be installed. Install at roughly 36" intervals. Do not install GrinderMinders directly into a mortar joint.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Wood blocking.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.

C. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less, no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.03 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

2.04 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.02 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 07 1416

COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Polyurethane waterproofing.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.04 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.06 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TWO-COMPONENT POLYURETHANE WATERPROOFING

A. Two-Component, Unmodified Polyurethane Waterproofing: ASTM C 836/C 836M.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Carlisle Coatings & Waterproofing Inc; CCW 703 Liquiseal.
b. Gaco Western LLC; GacoFlex LM-60.
c. Pacific Polymers International, Inc; Elasto-Deck B.T. Two-Component.
d. Urethane Polymers International, Inc; UIM-6430.

2.02 AUXILIARY MATERIALS

A. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.

B. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric.

C. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

D. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.
   1. Backer Rod: Closed-cell polyethylene foam.

2.03 PROTECTION COURSE

A. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Henry Company; Asphalt Protection Board.
      b. Soprema, Inc; Sopraboard.
      c. W. R. Meadows, Inc; Protection Course.
   2. Thickness: 1/8 inch, nominal, for vertical applications; 1/4 inch, nominal, elsewhere.
   3. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

F. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 1471.

G. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

H. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 1471. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

3.02 WATERPROOFING APPLICATION

A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 1471.

B. Reinforced Waterproofing Applications:
1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes, with an average dry film total thickness of 80 mils.

C. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
1. For horizontal applications, install protection course loose laid over fully cured membrane.
2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3.03 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

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

END OF SECTION

SECTION 07 1800

ELASTOMERIC COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes elastomeric coatings for cooling tower floor.

1.02 PREINSTALLATION MEETINGS

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.

B. Shop Drawings
   1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.04 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Sample warranty.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.06 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace coating that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.02 COATING

A. Coating: Manufacturer's standard, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for cooling tower floor; according to ASTM C 957/C 957M.
1. Design based on elastomeric coating manufactured by Leewens Corporation.

B. Primer: Liquid primer as recommended in writing for substrate and conditions by - coating manufacturer.

C. Preparatory and Base Coats: Polyurethane.

D. Intermediate Coat: Polyurethane.

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

F. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by coating manufacturer.

2.03 ACCESSORY MATERIALS

A. Sheet Flashing: Non-staining sheet material recommended in writing by coating manufacturer.

B. Adhesive: Contact adhesive recommended in writing by coating manufacturer.

C. Reinforcing Strip: Fiberglass mesh recommended in writing by coating manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for coating application.
1. Application of coating indicates acceptance of surfaces and conditions.

B. Mask adjoining surfaces not receiving coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent coating materials from entering deck substrate penetrations and clogging weep holes and drains.

C. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259. Do not acid etch.
   1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
   2. Remove concrete fins, ridges, and other projections.
   3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
   4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.02 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written instructions.

B. Provide sealant cants at penetrations and at reinforced and non-reinforced, deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.03 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

B. Apply reinforcing strip in coating system where recommended in writing by coating manufacturer.

3.04 COATING APPLICATION

A. Apply coating according to manufacturer's written instructions.

B. Apply coats of specified compositions for each type of coating at locations as indicated on Drawings.

C. Apply coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

D. Cure coatings.

3.05 PROTECTING AND CLEANING

A. Protect coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Manufactured reglets with counterflashing.
2. Formed wall sheet metal fabrications.

1.02 PREINSTALLATION MEETINGS

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.04 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1.07 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation pre-painted by coil-coating process to comply with ASTM A 755/A 755M.
1. Exposed Coil-Coated Finish:
a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
2. Color: As selected by Architect from manufacturer's full range.

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.05 MANUFACTURED REGLETS

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
   1. Material: Galvanized steel, 0.022 inch thick.
   2. Finish: With manufacturer's standard color coating.

2.06 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   1. Obtain field measurements for accurate fit before shop fabrication.

2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.01 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Roll laps and edges with roller. Cover underlayment within 14 days.

3.02 INSTALLATION, GENERAL

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

5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

F. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.03 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets: Installation of reglets is specified in Section 03 3000 "Cast-in-Place Concrete." Section 04 2000 "Unit Masonry."

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in the manufacturer's written installation instructions.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

1.02 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.03 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

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

1.04 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field-adhesion test reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1.06 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Furnish products of one of the following manufacturers subject to compliance with specifications requirements:
1. Pecora www.pecora.com
2. Tremco Vulkem Paraseal www.tremcosealants.com
3. Dow Corning Corp. www.dowcorning.com
4. General Electric www.ge.com
5. Sika Corp. www.sika.com
6. Sonneborn / Chemrex www.chemrex.com

2.02 MATERIALS, GENERAL

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": 2-part or 3-part (self-leveling) urethane, conforming to ASTM C920, Type M, Grade P, Class 25, Use T;
1) Pecora NR-200 Urexpan Sealant or Dynatred
2) Tremco THC-900/901
3) Vulkem 45/245
4) Sikaflex 2c SL (self-leveling)
5) Sonneborn SL-2.
b. Type "B": 3-part chemically curing polyurethane 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. 1) Tremco Dymeric 240 FC Sealant
2) Pecora Dynatrol II
3) Vulkem 922
4) Sikaflex 2c NS (non-sag)
5) Sonneborn NP-2.
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.
1) Dow Corning 790 Silicone Glazing Sealant
2) Tremco Spectrem 1
3) 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.
1) Tremco Spectrem 2
2) Pecora 895
3) Dow Corning 795
4) Dow Corning 791
5 GE Silpruf.

e. Type "D": ASTM C920, Type S, Grade NS, Class 25, Use NT, M,A,O.
1) Sika Sikaflex 1A
2) Pecora Dynatrol 1
3) Tremco DyMonic FC
4) Pecora 345
5) Sonneborn NP-1.

f. Type "E": Silicone rubber sealant with mold inhibitor.
1) General Electric Sanitary 1700
2) Tremco Tremsil 200
3) Dow Corning 786
4) Pecora 898
5) Sonneborn Omni-Plus.

g. Type "F":
1) Tremco Acoustical Sealant
2) Pecora BA-98.

3. Color: Provide standard or custom colors as selected by Architect. In general, colors shall match adjacent materials.

C. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

E. Joint Filler (Backer):
1. Buildings: ASTM C1330, Type B; round bi-cellular or closed cell polyethylene or polyolefin, or open cell polyurethane foam rod as recommended by the sealant manufacturer for the application; oversized 30 to 50 percent; "SofRod" as manufactured by Nomaco, or as approved.
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.

F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.03 JOINT SEALANT BACKING

C. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

D. Existing Exterior Joints: Remove existing sealant, clean joint as indicated above, and apply new sealant.

3.02 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

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

3.03 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.04 JOINT-SEALANT SCHEDULE

Install sealants at locations scheduled below and also where noted on drawings.

A. Expansion and Control Joints at:
1. Horizontal traffic (concrete, tile, terrazzo and similar floor surfaces): Type "A". Provide gloss reducer.
2. Masonry, concrete to concrete, stucco, steel and wood: 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".

B. Non-expanding Joints at:
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. Concrete to concrete, stucco, masonry, aluminum, steel, and wood: Type "D".

C. Mechanical (ductwork and air conditioning): Type "D".

D. Plumbing Fixtures (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 07 9500

EXPANSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior wall expansion control systems.

1.02 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, block out requirement, attachments to other work, and line diagrams.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

2.02 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Design based on Construction Specialties, Inc. Subject to compliance with requirements, one of the following products may be accepted:
   1. Balco, Inc.
   2. EMSEAL Corporation.
   3. JointMaster/InPro Corporation.
   4. MM Systems Corporation.
   5. Nystrom, Inc.
   6. Tremco Incorporated.
   7. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
   1. Basis-of-Design Product: HF and VF Series.
   2. Design Criteria:
      a. Joint Width: As indicated on Drawings.

3. Type: Cover plat: PC Series.

2.03 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover. Equip moisture barrier with drain tubes and seals to direct collected moisture to exterior-wall expansion control system.

2.04 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.

2.05 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Foam Seals: Install with adhesive recommended by manufacturer.

C. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

D. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings.

3.03 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete.

B. Protect the installation from damage by work of other Sections.

END OF SECTION

SECTION 08 9119

FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes fixed, extruded-aluminum louvers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Windborne-debris-impact-resistance test reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.02 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:
1. Manufacturers: Design is based on Model ELF375XH Stationary Louver.
2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.125 inch for blades and frames.
4. Mullion Type: Exposed.

5. Louver Performance Ratings:
   a. Free Area: As determined by mechanical engineer.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.03 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Bird screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:
   1. Bird Screening: Aluminum, 1/2-inch square mesh, 0.063-inch wire.

2.04 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180) zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 4 finish, with grain running parallel to length of blades and frame members.

E. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
   4. For fastening stainless steel, use 300 series stainless-steel fasteners.
   5. For color-finished louvers, use fasteners with heads that match color of louvers.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.05 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.06 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: As selected by Architect from full range of industry colors and color densities.

B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.02 ADJUSTING

A. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 2400

CEMENT PLASTERING (STUCCO)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Exterior portland cement plasterwork (stucco) on unit masonry and monolithic concrete.

1.02 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

1.03 QUALITY ASSURANCE

A. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.01 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
2. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
3. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
4. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

5. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.02 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

2.03 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.
1. Color for Finish Coats: Gray.

B. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match Architect's sample.

C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

D. Sand Aggregate: ASTM C 897.
1. Color for Job-Mixed Finish Coats: White.

E. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
1. Color: As selected by Architect from manufacturer's full range.

2.04 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.
1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

C. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 1-1/2 to 2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.02 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:
1. Install lath-type, external-corner reinforcement at exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings.

3.03 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

B. Bonding Compound: Apply on unit masonry and concrete plaster bases.

C. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch thick on concrete masonry, 1/4 inch thick on concrete.
1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide finish to match Architect's sample.

3.04 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION

SECTION 09 9113

EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.
   1. Steel.
   2. Galvanized metal.

1.02 DEFINITIONS

A. Gloss Level 1 (Matte, Flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (Velvet, Flat): Not more than 10 units at 60 degrees and 35 units at 85 degrees, according to ASTM D 523

C. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (High Gloss): More than 85 units at 60 degrees, according to ASTM D 523.

H. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the U.S. EPA

I. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.

J. RAVOC: Reactivity adjusted VOC 'Reactivity' means the ability of a VOC to promote ozone formation.

K. PDCA: Painting & Decorating Contractors of America www.pdca.org.

L. SSPC: Scopes of SSPC Surface Preparation Standards and Specifications. www.sspc.org.

M. Bio-Pruf: Biostabilizing additive, to protect products from premature microbial degradation.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
1. Submit Samples on rigid backing, no smaller than 7 inches by 10 inches or larger than 8.5 inches by 11 inches.
2. Label each Sample for project, architect, general contractor, painting contractor, paint color name and number, paint brand name, "P" number if applicable, and application area.

C. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Following the format prescribed in Part 2. PRODUCTS, submit physical properties data and appropriate test results for each proposed product substitution.
3. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
4. VOC content.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F or more than 120 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.06 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 105 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products from products by one of the following:
   1. Dunn Edwards Corp.
   2. Sherwin-Williams

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

C. MPI numbers may not be included for each product. In this case, a comparable product has been included.

2.02 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.

D. Colors: As scheduled.

2.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will comply with requirements to use compatible products and systems as described in Paragraph 2.02.A. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.

2. 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.
3. 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.
4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
5. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
6. Paint entire exposed surface of window frames and sashes.
7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
8. Priming may not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required ensuring an even primed surface before applying finish coat.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
   a. Equipment, including panelboards and switch gear.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. Latex over Alkyd Primer System:
      a. Prime Coat: Alkyd emulsion, anti-corrosive for metal, MPI #107.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior semi-gloss, 100% acrylic, (Gloss Level 5), MPI #11.

B. Portland Cement (Stucco):
   1. Latex over Alkyd Primer System:
      a. Primer, Alkali Resistant: Water based, MPI #3.
      b. Intermediate Coat and Topcoat: Latex, Flat, MPI#42.

END OF SECTION

SECTION 32 3121

ALUMINUM LOUVER GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars, including extruded aluminum fence posts and aluminum louver gates.

B. Related sections:
1. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM B117 - Operating Salt Spray (Fog) Apparatus.
2. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
1. ASTM D822 - Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
2. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
3. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.03 SUBMITTALS

A. Provide in accordance - Submittal Procedures of the Technical Specifications:
1. Product data for components and accessories.
2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.
3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.
4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

1.04 WARRANTY

A. Provide in accordance with Section 01 7700 - Closeout Procedures:
1. 10-year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Design based on products manufactured Ametco Manufacturing Corporation -Phoenix Design Gate.

2.02 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209, Alloy 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

2.03 GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging double gate.
   1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material. Size as recommended by manufacturer.
   2. Hardware:
      a. Hinges: Size and type as determined by manufacturer. Provide 2 hinges for each leaf up to 6 feet high and 1 additional hinge for each additional 24 inches in height or fraction thereof.
      b. Latch: 3/4 inch diameter slide bolt to accommodate padlock.
      c. For double gates provide padlockable, 5/8 inch diameter center cane bolt assembly and strike.

2.04 ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

B. For exposed locations, provide anti-intruder bolts consisting of cup-head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.05 FACTORY FINISH

A. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
   2. Minimum hardness measured in accordance with ASTM D3363: 2H.
   3. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.
   4. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inch undercutting.
   5. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

B. Color: Selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to fabrication, field verify required dimensions.

3.02 INSTALLATION

A. Gates:
   1. Install gates and adjust hardware for smooth operation.
   2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.
   3. After installation, test gate. Open and close a minimum of five times. Correct deficiencies and adjust.

B. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION

151535

Job No. 15-673 Sheet No. Cover

By DTN Date 10/15

CARUSO
TURLEY
SCOTT
structural
engineers

Registered Professional Engineer (Structural)
CERTIFICATE NO.
42194
BRADY K.
NOTBOHM
11-12-15
Date Signed
ARIZONA, U.S.A.

EXPIRES 03-31-17

CLIENT:

Pearson Engineering Associates Inc.
8825 N. 23rd Ave
Phoenix, AZ 85021

PROJECT:

City Hall Cooling Tower Replacement
5850 West Glendale Ave

STRUCTURAL
ENGINEERING
EXCELLENCE

PARTNERS
Richard Turley, PE
Paul Scott, PE, SE
Sandra Heard, PE, SE, LEED AP
Chris Atkinson, PE, SE, LEED AP
Thomas Morris, PE, LEED AP
Richard Dahlmann, PE

GENERAL INFORMATION:

BUILDING CODE: 2012 IBC, ASCE 7-10

Scope:

- Add site wall supported on grade beams and drilled peirs
- Add 3-9000# max mechanical units supported on steel frame and drilled piers

Delta 1 - City Comments

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Job Name Murrieta Police Solar

Job No. 15-054 Sheet No. Index

By DTN Date 1/15

CALCULATION INDEX SHEET

SHEET #	DESCRIPTION
A	Basis For Design
1 – 2	Wind Analysis
3	Site Wall Design
4 - 15	Grade Beam And Drilled Pier Design
16	Site Wall Lintel Design
17 – 22	Steel Frame Design (Mechanical Unit Supports)

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Job Name Glendale cooling tower

Job No. 15-673 Sheet No. A

By DTN Date

BASIS FOR DESIGN

BUILDING CODE: 2012 EDITION OF THE INTERNATIONALBUILDING CODE
ASCE/SEI 7-10 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES

LOADS:

WIND:
3 SECOND WIND GUST = 115 MPH.
RISK CATEGORY = II.
EXPOSURE C.

FOUNDATIONS: GEOTECHNICAL REPORT BY SPEEDIE AND ASSOCIATES; JOB NO. 151538SA.CAISSON CONCRETE SHALL BE PLACED ON CLEAN INSPECTED BEARING A MINIMUM OF 15'-0" INTO BEARING STRATA. ASSUME TOP OF BEARING STRATA 2'-0" BELOW FINISHED FLOOR. EXACT BEARING ELEVATION SHALL BE FIELD VERIFIED BY SOILS ENGINEER AT THE TIME OF DRILLING. DESIGN SOIL BEARING VALUE = 90KIPS. REFER TO GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION PRIOR TO COMMENCEMENT OF EARTHWORK.

CONCRETE: MINIMUM 28 DAY STRENGTH:
FOUNDATIONS AND CAISSONS ---------- 2,500 PSI

REINFORCING: BARS #5 AND LARGER: Fy = 60,000 PSI.
BARS #4 AND SMALLER: Fy = 40,000 PSI.

STRUCTURAL STEEL: BEAMS AND COLUMNS: Fy = 50 KSI
PLATE STEEL: Fy = 36 KSI

WINDSPEED BY LOCATION

Applied Technology Council

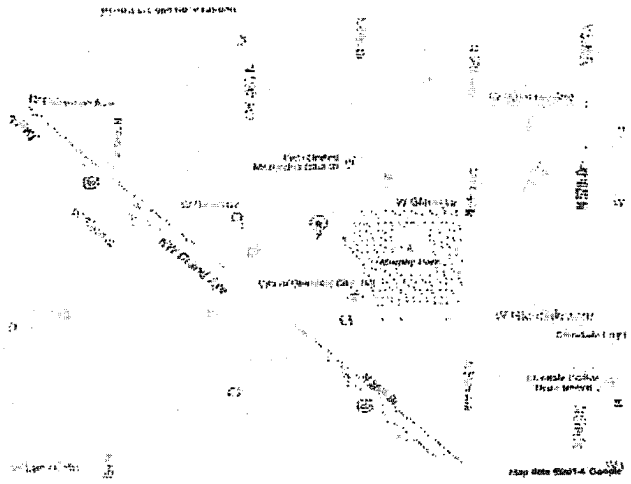
Search Results

Latitude: 33.5394
Longitude: -112.1854

ASCE 7-10 Wind Speeds (3-sec peak gust MPH*):

Risk Category I: 105
Risk Category II: 115
Risk Category III-IV: 120
MRI 10 Year:** 76
MRI 25 Year:** 84
MRI 50 Year:** 90
MRI 100 Year:** 96

ASCE 7-05: 90
ASCE 7-93: 72



*MPH(Miles per hour)
**MRI Mean Recurrence Interval (years)
Users should consult with local building officials to determine if there are community-specific wind speed requirements that govern.

WIND SPEED WEB SITE DISCLAIMER:
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CARUSO TURLEY SCOTT INC.
consulting structural engineers

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Tempe, Arizona 85281
480-774-1700

Job Name:

Job No: 15-673 Sheet No: 2

By: DTN Date: 10/15

Fence Wind Loading (Section 29.4, ASCE 7-10) - Exp C

Section 29.3.2

Velocity Pressure = $q_h = 0.00256\, K_z\, K_{zt}\, K_d\, V^2$ (Eqn 23.3-1)

3 -Sec Wind Gust =	V =	115			mph	
Exposure Coeff =	K_z =	0.85				(Section 29.3.1, h≤ 15 ft)
Topographic Factor =	K_{zt} =	1.0				(Section 26.8.2)
Directional Coeff =	K_d =	0.85				(Section 26.6)
	q_h =	24.5			psf	

Section 29.4.1

Wind Load = $F = q_h\, G\, C_f\, A$ (Eqn 29.4-1)

Gust Factor =	G =	0.85				(Section 26.9.1)
Force Coeff =	C_f =	1.3				(Fig 29.4-1, B/s = 10)
Wall Area =	A =	1.0			ft^2	
	Increase* =	1.1				(See below)
Wind Pressure =	F =	29.7			psf	(Basic Ultimate Load)
Wind Pressure =	F =	17.8			psf	(Basic ASD Load - 0.6W)

* Per Footnote 3, Fig 29.4-1, resultant force of wind pressure is to act at 0.05 times the average height of the wall.
To account for this, increase the wind load using equivalent moments.

$$\frac{w_e l^2}{2} = wl\left(l/2 + l(0.05)\right)$$

$$w_e = 0.55w(2) = 1.1w$$

Increase wind by 10%

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Project Title:
Engineer:
Project Descr:

Project ID: 3

Printed: 26 OCT 2015, 10:13AM

Cantilevered Retaining Wall

File = G:_CDF16~1\15673C~1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC 1983-2015, Build:6.15.10.6, Ver:6.15.10.6

Lic. # : KW-06000624 — Licensee : caruso turley scott

Description : Wall calc

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	0.00 ft
Wall Height above soil	=	23.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water Height over Heel	=	0.0 ft

Vertical component of active Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	45.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure	=	389.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

Wind on Exposed Stem = 17.8 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	0.38 UNSTABLE!
Sliding	=	4.11 OK
Total Bearing Load	=	3,559 lbs
...resultant ecc.	=	23.37 in
Resultant Exceeds Ftg. Width!		
Soil Pressure @ Toe	=	0 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	0 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	1.4 psi OK
Allowable	=	75.0 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	430.2 lbs
less 100% Passive Force	= -	345.8 lbs
less 100% Friction Force	= -	1,420.6 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	22.50	0.00
Wall Material Above "Ht"	=	Masonry	Masonry
Thickness	in =	12.00	12.00
Rebar Size	=	# 6	# 6
Rebar Spacing	in =	8.00	16.00
Rebar Placed at	=	Edge	Edge
Design Data			
fb/FB + fa/Fa	=	0.000	0.863
Total Force @ Section	lbs =	8.9	409.4
Moment....Actual	ft-l =	2.2	4,708.1
Moment.....Allowable	ft-l =	6,915.5	5,454.2
Shear.....Actual	psi =	0.1	3.8
Shear.....Allowable	psi =	38.7	38.7
Wall Weight	psf =	133.0	133.0
Rebar Depth 'd'	in =	9.00	9.00
Lap splice if above	in =	36.00	54.00
Lap splice if below	in =	36.00	10.41
Hook embed into footing	in =	36.00	10.41
Masonry Data			
f'm	psi =	1,500	1,500
Fs	psi =	24,000	25,600
Solid Grouting	=	Yes	Yes
			Yes
Modular Ratio 'n'	=	21.48	21.48
Short Term Factor	=	1.000	1.000
Equiv. Solid Thick.	in =	11.60	11.60
Masonry Block Type	=	3	
Masonry Design Method	=	ASD	

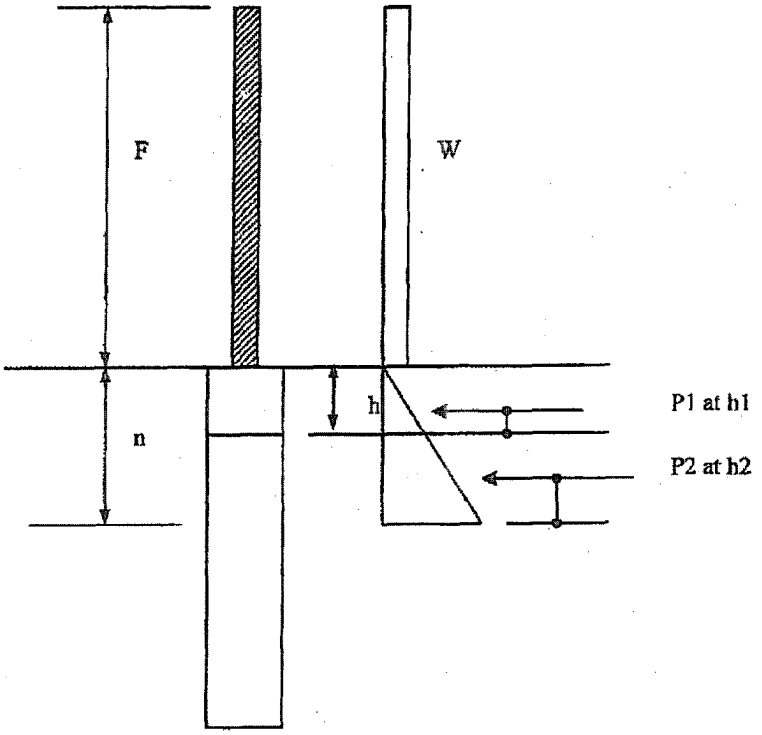
See grade beam design

Grade Beam Torsional Strength with Ties - No Retaining, Neglect Soil

Grade Beam Depth	b =	24 in	No of Bar		4
Grade Beam Height	h =	30 in	Phi		0.85
Stirup Spacing	s =	10 in	Yield Strength		40000 psi
Steel Area of Stirrup	As =	0.20 in^2			

= user input required

Aoh =	411.25	*Aoh = (b-6-bar number/8)*(h-6-bar number/8)*
Ao =	349.56	*Ao = Phi*Aoh*
Tn =	39617.08	*Tn = 2*Phi*Ao*As*Fy/s*



Sketch of Pier and Grade Beam

Spacing and Moment Calculations for Wall

Wind	W =	29.7 psf	Pier Dia	D =	2 ft
Active	A =	40 pcf	Neglected Depth	n =	2 ft
Capacity	Tn =	39617 ft-lbs	Grade Beam Depth	h =	1 ft
Force P1 at	h1 =	0.333 ft	Soil Pier Load	P2 =	120 lbs
Force P2 at	h2 =	0.500			

Fence Height F (ft)	Torsion Force Tu (ft-lbs)	Required Pier Spacing Smax (ft)	Actual Spacing S (ft)	Wind Wall Load Wll (plf)	Soil Grade Beam Load P1 (lbs)	Soil Moment M (ft-lbs)	Total Soil P (lbs)	Total Soil Force at y (ft)
23.00	342.38	233.42	20	594.00	400.00	233.333	520.00	0.449
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833
0.00	0.83	95083.00	0	0.00	0.00	100.000	120.00	0.833

= user input required = values into Enercalc

$$T_u = W * F * \frac{h}{2} + \frac{1}{6} * A * \left(\frac{h}{2}\right)^3 \qquad S_{max} = \frac{2T_n}{T_u} + D \qquad W_{ll} = W * S$$

$$P_1 = 0.5 * A * h^2 * S \qquad h_1 = \frac{h}{3} \qquad P_2 = 0.5 * A * D * (n^2 - h^2)$$

$$h_2 = \frac{n - h}{2} \qquad P_s = P_1 + P_2 \qquad M_s = P_1 * h_1 + P_2 * h_2 \qquad y = \frac{M_s}{P_s}$$

Wll is the distributed load on fence due to the wind. This must be applied from the top of the neglected height to the top of the fence.

P is the total soil load on the pier resulting from the soil load on the grade beam plus the soil load on the pier due to the neglected soil.

y is the height to the point of application for the total soil load.

The soil load and its location, along with the distributed load on the fence are placed into Enercalc to determine a pier depth. The pier depth starts at the bottom of the neglection. The neglection must be added to the calc'd pier depth for a total depth of the pier.

Pier Vertical Reinforcing

Pier / Caison Diameter [ft]	Point Load on Pier [lb]	Clear Cover for Pier [in]
2.00	8197	3.5

=user input required
=calc'd values

Maximum Moment on Pile Calculation = Ho * L *[(E / L + X / L) - (4 * E / L + 3) * (X / L)^3 + (3*E/L + 2) * (X / L)^4] = [ft-lb/ft] =

Ho = Lateral force per foot width of pole diameter, applied at the resisting surface, Pounds per foot of Diameter =

L = Required depth of pile, measured from the resisting surface [ft] = 14.625

E = Distance from Lateral Load to resisting surface, ft = 11.5

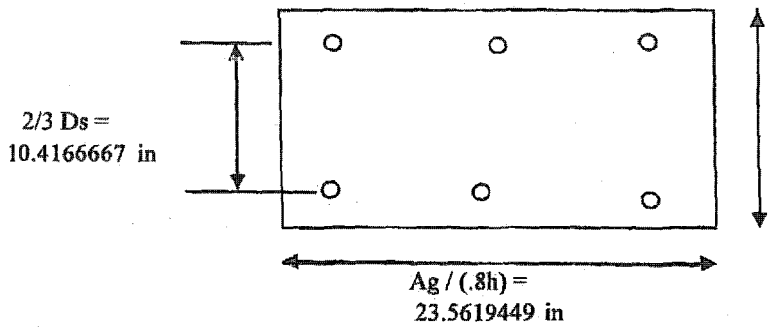
X = Distance along pile, measured from resisting surface = a/2 (max moment) =

Maximum Moment Occurs at a/2, a = (4 * E * L + 3 * L^2) / (6 * E + 4 * L) = ft

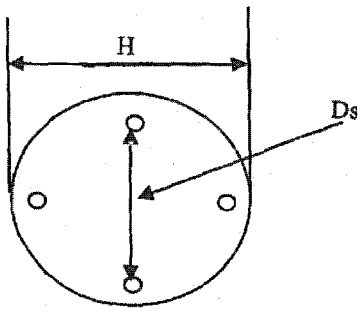
E / L = X / L =

Design Moment for Pile Mu = 1.3 * Pole Diameter * Max Moment on Pile = [ft - lb] =

Convert Circular Pier into Equivalent Rectangular Section:



.8H =
19.2 in



Ds = Diamter of Caisson - Cover * 2 - Stirrup - 1 db (assume 5/8") = 15.625 in

Deffective =.8H-cover= 15.7 in

Steel Required for Caisson

b [in]	deff [in]	f_c [psi]	f_y [psi]	M_u [in-lbs]	Steel to be Used
[illegible]	[illegible]	2500	60000	[illegible]	6

ρ Required	ρ Min 200/f_y	ρ Min $3(f_c)^{.5}/f_y$	ρ min 4/3 req	ρ_{max}
0.00611719	0.00333333	0.0025	0.00815626	0.01336256

Use ρ	As req
0.003333	1.23295181

Use [illegible] Bars (total) Vertical Reinforcement

Beta		
0.85	< 4000	0.01336256
0.8	<5000	0.01257653
0.75	< 6000	0.0117905

Hairpin Connection

d [in]	α [-]	λ [-]	β [-]	d_b [in]	Tension Ft [psi]
[illegible]	1	1	1	[illegible]	[illegible]

d=Caisson Diameter (in) -Cover

$F_t = 0.9 * f_y$

Development Length, l_d = [illegible] in

Hook Development Length, l_{dh} = [illegible] in

Rebar Tension, T = [illegible] lbs

Required Hairpin Steel, A_{sr} = [illegible] in^2

$$T = \frac{M_u}{d}$$

$$A_{sr} = \frac{T}{F_t}$$

Use [illegible] Bars[illegible]

$$l_d = \frac{d_b * f_y * \alpha * \beta * \lambda}{25 * \sqrt{f'_c}}$$

$$l_{dh} = \frac{0.02 * \beta * \lambda * f_y * d_b}{\sqrt{f'_c}}$$

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Project Title:
Engineer:
Project Descr:

Project ID:

Printed: 26 OCT 2015, 10:28AM

Pole Footing Embedded in Soil

File = G:_COF16-1\15873C-1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.6
Lic. #: KW-06000624 License : caruso turley scott

Description : drilled pier

Code References

Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-10

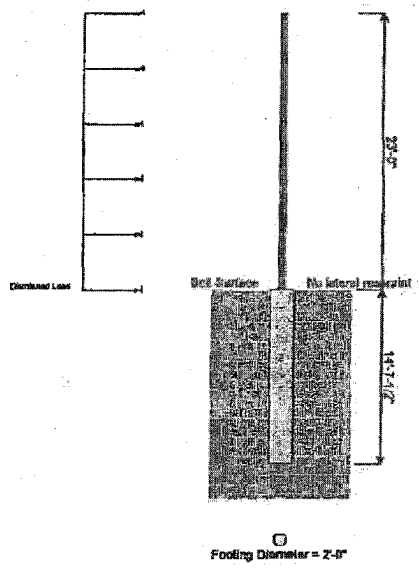
General Information

Pole Footing Shape	Circular
Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	250.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination : +D+0.60W+H

Lateral Load	8.197 k
Moment	94.268 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	1,218.12 psf
Allowable	1,218.56 psf
Minimum Required Depth	**14.625 ft**
Footing Base Area	3.142 ft^2
Maximum Soil Pressure	0.0 ksf



Applied Loads

	Lateral Concentrated Load		Lateral Distributed Load	Vertical Load
D : Dead Load	k		k/ft	k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	k
W : Wind	k	0.5940	k/ft	k
E : Earthquake	k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	ft	TOP of Load above ground surface 23.0 ft		
		BOTTOM of Load above ground surface ft		

Load Combination Results

Load Combination	Forces @ Ground Surface Loads - (k)	Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth Actual - (psf)	Allow - (psf)	Soil increase Factor
+D+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+L+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+Lr+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+S+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750Lr+0.750L+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750L+0.750S+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W+H	8.197	94.268	14.63	1,218.1	1,218.6	1.000
+D+0.70E+H	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750Lr+0.750L+0.450W+H	6.148	70.701	13.13	1,084.0	1,085.2	1.000

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Project Title:
Engineer:
Project Descr:

Project ID: 10

Printed: 12 NOV 2015, 11:37AM

Concrete Beam

File = G:_CDF16-1\15673C-1\CALCUL-1\WALLCA-1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31
Lic. # : KW-06000624
Licensee : caruso turley scott

Description : gravity

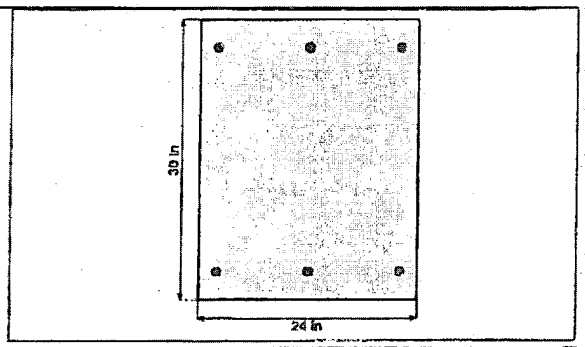
CODE REFERENCES

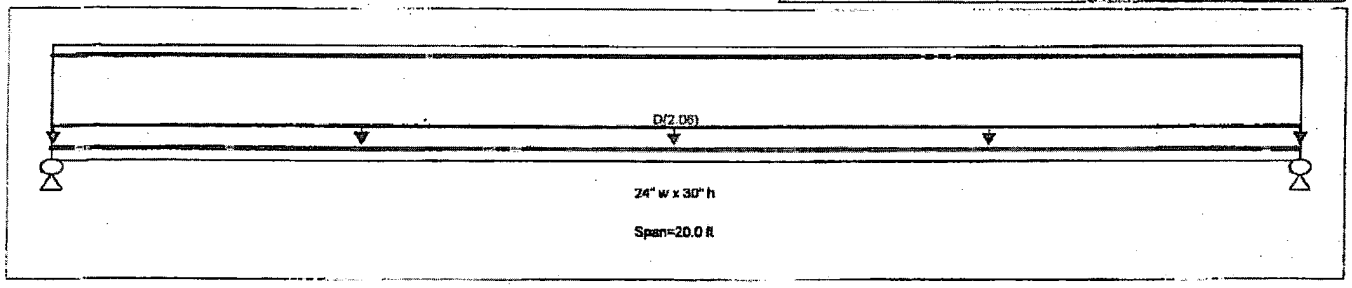
Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c ^2 * 7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	150.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	2,880.95 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	# 3
			Number of Resisting Legs Per Stirrup	=	1.0

Load Combination ASCE 7-10





Cross Section & Reinforcing Details

Rectangular Section, Width = 24.0 in, Height = 30.0 in
Span #1 Reinforcing...
3-#8 at 3.0 in from Bottom, from 0.0 to 20.0 ft in this span
3-#8 at 3.0 in from Top, from 0.0 to 20.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 2.060 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.721 : 1	Maximum Deflection			
Section used for this span	Typical Section	Max Downward Transient Deflection	0.000 in	Ratio =	0 <360
Mu : Applied	196.699 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Mn * Phi : Allowable	272.930 k-ft	Max Downward Total Deflection	0.096 in	Ratio =	2508
Load Combination	+1.40D+1.60H	Max Upward Total Deflection	0.000 in	Ratio =	999 <180
Location of maximum on span	10.018 ft				
Span # where maximum occurs	Span # 1				

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	28.100	28.100
Overall MINimum	16.860	16.860
+D+H	28.100	28.100
+D+L+H	28.100	28.100
+D+Lr+H	28.100	28.100
+D+S+H	28.100	28.100
+D+0.750Lr+0.750L+H	28.100	28.100
+D+0.750L+0.750S+H	28.100	28.100
+D+0.60W+H	28.100	28.100
+D+0.70E+H	28.100	28.100
+D+0.750Lr+0.750L+0.450W+H	28.100	28.100
+D+0.750L+0.750S+0.450W+H	28.100	28.100
+D+0.750L+0.750S+0.5250E+H	28.100	28.100
+0.60D+0.60W+0.60H	16.860	16.860

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Project Title:
Engineer:
Project Descr:

Project ID: 11

Printed: 12 NOV 2015, 11:37AM

Concrete Beam

File = G:_CDF16-1156730-1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.91

Lic. # : KW-06000624 — Licensee : caruso turley scott

Description : gravity

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D+0.70E+0.60H	16.860	16.860
D Only	28.100	28.100
Lr Only		
L Only		
S Only		
W Only		
E Only		
H Only		

Shear Stirrup Requirements

Between 0.00 to 3.86 ft, PhiVc/2 < Vu <= PhiVc, Req'd Vs = Min 11.5.6.3, use stirrups spaced at 3.000 in
Between 3.90 to 16.10 ft, Vu < PhiVc/2, Req'd Vs = Not Reqd 11.4.6.1, use stirrups spaced at 0.000 in
Between 16.14 to 19.96 ft, PhiVc/2 < Vu <= PhiVc, Req'd Vs = Min 11.5.6.3, use stirrups spaced at 3.000 in

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.0957	10.000		0.0000	0.000

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Project Title:
Engineer:
Project Descr:

Project ID: 12

Printed: 12 NOV 2015, 11:38AM

Concrete Beam

File = G:\CDF16-1\15673C-1\CALCUL-1\WALLCA-1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31

Lic. # : KW-06000624 Licensee : caruso turley scott

Description : lateral

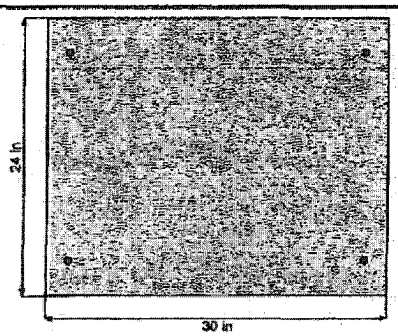
CODE REFERENCES

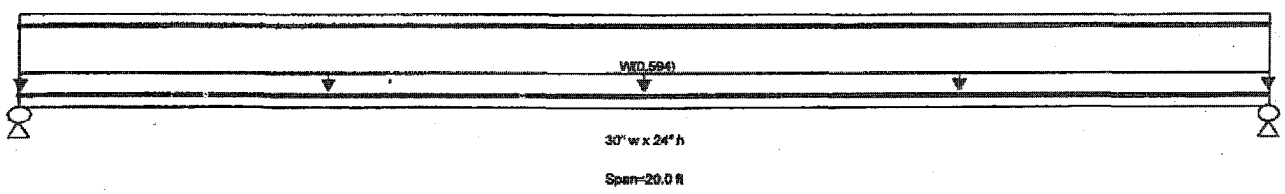
Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	2,880.95 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	# 3
			Number of Resisting Legs Per Stirrup	=	2

Load Combination ASCE 7-10





Cross Section & Reinforcing Details

Rectangular Section, Width = 30.0 in, Height = 24.0 in
Span #1 Reinforcing...
2-#5 at 3.0 in from Bottom, from 0.0 to 20.0 ft in this span

using 1 #8 bar
2-#5 at 3.0 in from Top, from 0.0 to 20.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
Uniform Load : W = 0.5940 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.466 : 1	Maximum Deflection	
Section used for this span	Typical Section	Max Downward Transient Deflection	0.021 in Ratio = 11178
Mu : Applied	29.70 k-ft	Max Upward Transient Deflection	0.000 in Ratio = 0 <360
Mn * Phi : Allowable	63.704 k-ft	Max Downward Total Deflection	0.013 in Ratio = 18630
Load Combination	+1.20D+0.50Lr+0.50L+W+1.60H	Max Upward Total Deflection	0.000 in Ratio = 999 <180
Location of maximum on span	9.982 ft		
Span # where maximum occurs	Span # 1		

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	5.940	5.940
Overall MINimum	2.673	2.673
+D+H		
+D+L+H		
+D+Lr+H		
+D+S+H		
+D+0.750Lr+0.750L+H		
+D+0.750L+0.750S+H		
+D+0.60W+H	3.564	3.564
+D+0.70E+H		
+D+0.750Lr+0.750L+0.450W+H	2.673	2.673
+D+0.750L+0.750S+0.450W+H	2.673	2.673
+D+0.750L+0.750S+0.5250E+H		
+0.60D+0.60W+0.60H	3.564	3.564
+0.60D+0.70E+0.60H		

Area steel 2 #5 = .62 in²
Area steel 1 #8 = .79 in²
ok

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Project Title:
Engineer:
Project Descr:

Project ID: 13

Printed: 12 NOV 2015, 11:38AM

Concrete Beam

File = G:_CDF16-1115873C-1\CALCUL~1\WALLCA~1.EC8
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.31

Lic. # : KW-06000624 — Licensee : caruso turley scott

Description : lateral

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
D Only		
Lr Only		
L Only		
S Only		
W Only	5.940	5.940
E Only		
H Only		

Shear Stirrup Requirements

Entire Beam Span Length : Vu < PhiVc/2, Req'd Vs = Not Reqd 11.4.6.1, use stirrups spaced at 0.000 in

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.0215	10.000		0.0000	0.000

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Job Name _____

Job No. _____ Sheet No. 19

By _____ Date _____

Shear strength at Grade beam

$\phi V_c = 2 \phi b_w d \sqrt{f_c'} = 2 \cdot .75 \cdot 24" \cdot (30"-3"-.5") \sqrt{2500}$

$\phi V_c = 47.7 \text{ K}$

$\phi V_c/2 = 23.8 \text{ K}$

Shear force

$V_u = [(20' \cdot 20'/2 \cdot 103) + (2 \cdot 2.5 \cdot 150 \cdot 20'/2)] \cdot 1.2 = 33.72 \text{ K}$

$V_u > \phi V_c/2$ Shear reinforcing required

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Job Name _____

Job No. _____ Sheet No. 15

By _____ Date _____

Torsion Reinforcement

$A_{OH} = (24" - 6" - .5)(30 - 6 - .5) = 411 \text{ in}^2$

Area of Stirrup

$\frac{A}{S} = Tu / 1.7 \phi A_{OH} f_y$

$A/S = 298 \text{ ft-k}s / 1.7 \cdot .175 \cdot 411 \cdot 40 = .014 \text{ in}^2/\text{in}/\text{Arm}$

$.168 \text{ in}^2/\text{ft}/\text{Arm}$

Min Area

$\frac{A_v + 2A_t}{S} = \frac{50 b_w}{F_{yt}} = \frac{50(24)(12"/\text{ft})}{60\,000} = .24 \text{ in}^2/\text{ft}$

Perimeter of Stirrup

$P_h = 2[24 - 3 - 3 - .5] + 2[30 - 3 - 3 - .5] = 83 \text{ in}$

Maximum Stirrup Spacing

$S_{max} = P_h/8 = 83 \text{ in}/8 = 10.375 \Rightarrow 10" \text{ oc}$

Area provided

$A/S = .2(2)/1' = .4 \text{ in}^2 \geq .24 \text{ in}^2$ ok Use #4 @ 10' oc

Longitudinal Reinforcing

$A_c = \frac{A_E}{S} p_h \left(\frac{F_{yt}}{F_y}\right) = .168 \frac{(83")\left(\frac{60 \text{ ksi}}{60 \text{ ksi}}\right)}{12"/\text{ft}} = 1.162 \text{ in}^2$

$1.162/.44 = 2.64 \approx 3$ Use 3 #6 long min

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Project Title:
Engineer:
Project Descr:

Project ID: 16

Printed: 28 OCT 2015, 10:32AM

Masonry Beam

File = G:_CDF16~1\15673C~1\CALCUL~1\WALLCA~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.10.6, Ver:6.15.10.6
Lic. #: KW-06000624 Licensee: caruso turley scott

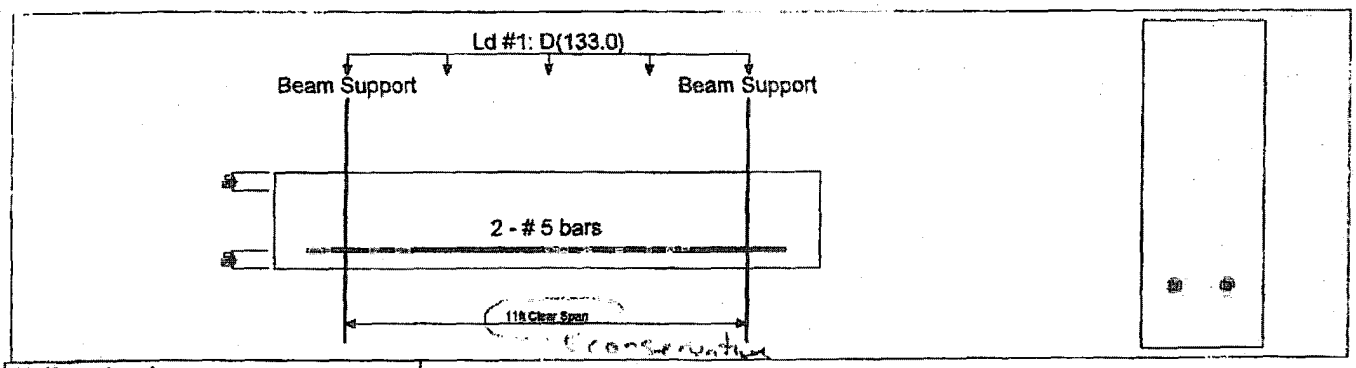
Description : lintel

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-10

General Information

f'm	1,500.0 psi		Clear Span	11.0 ft	Rebar Size	5.0
Fs	24,000.0 psi		Beam Depth	2.667 ft	# Bars E/F	2
Em = f'm *	750.0		Thickness	12 in	Top Clear	6.0 in
Wall Wt Mult	1.0		End Fixity	Pin-Pin	Btm Clear	6.0 in
Block Type	Normal Wt		Equiv. Solid Thick	11.60 in	# Bar Sets	1
Lateral Wind Load	17.80 psf		Wall Weight	133.0 psf	Bar Spacing	5.0 in
Lateral Wall Weight Seismic Factor		0.330	E	1,125.0 ksi		
Calculate vertical beam weight ?		Yes	n	25.778		



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	11.0 ft	1.596					k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...	Vertical	Lateral	Combined
fb/Fb	0.5211	0.1331	**0.5378** : 1.00
fv/Fv	0.8146	0.04374	**0.8157** : 1.00

OK

Maximum Moment	Actual	Allowable
Vertical Loads for Load Combination : +D+H	29.504 k-ft	56.619 k-ft
Lateral Loads for Load Combination : +D+0.70E+H	1.239 k-ft	9.305

Maximum Shear	Actual	Allowable
Vertical Loads for Load Combination : +D+H	35.491 psi	43.571 psi
Lateral Loads for Load Combination : +D+0.70E+H	1.694 psi	38.730 psi

Minimum Mn = 1.3 * For * S = 21.499 k-ft

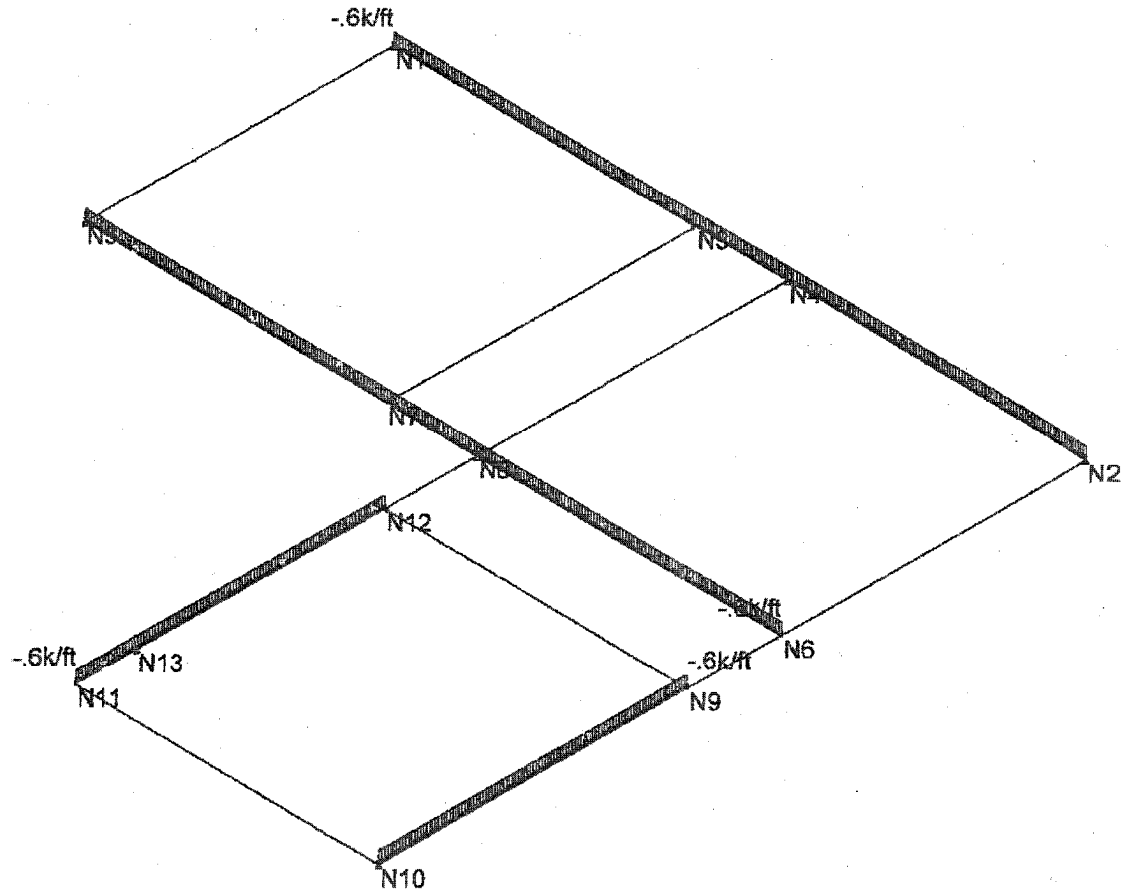
Vertical Strength

As	1.240 in^2
rho	0.004102
np	0.1057
k : ((np)^2+2np)^.5-np	0.3661
j = 1 - k/3	0.8780
M:mas=Fb k j b d^2/2	71.068 k-ft
M:Stl = Fs As j d	56.619 k-ft

Lateral Strength

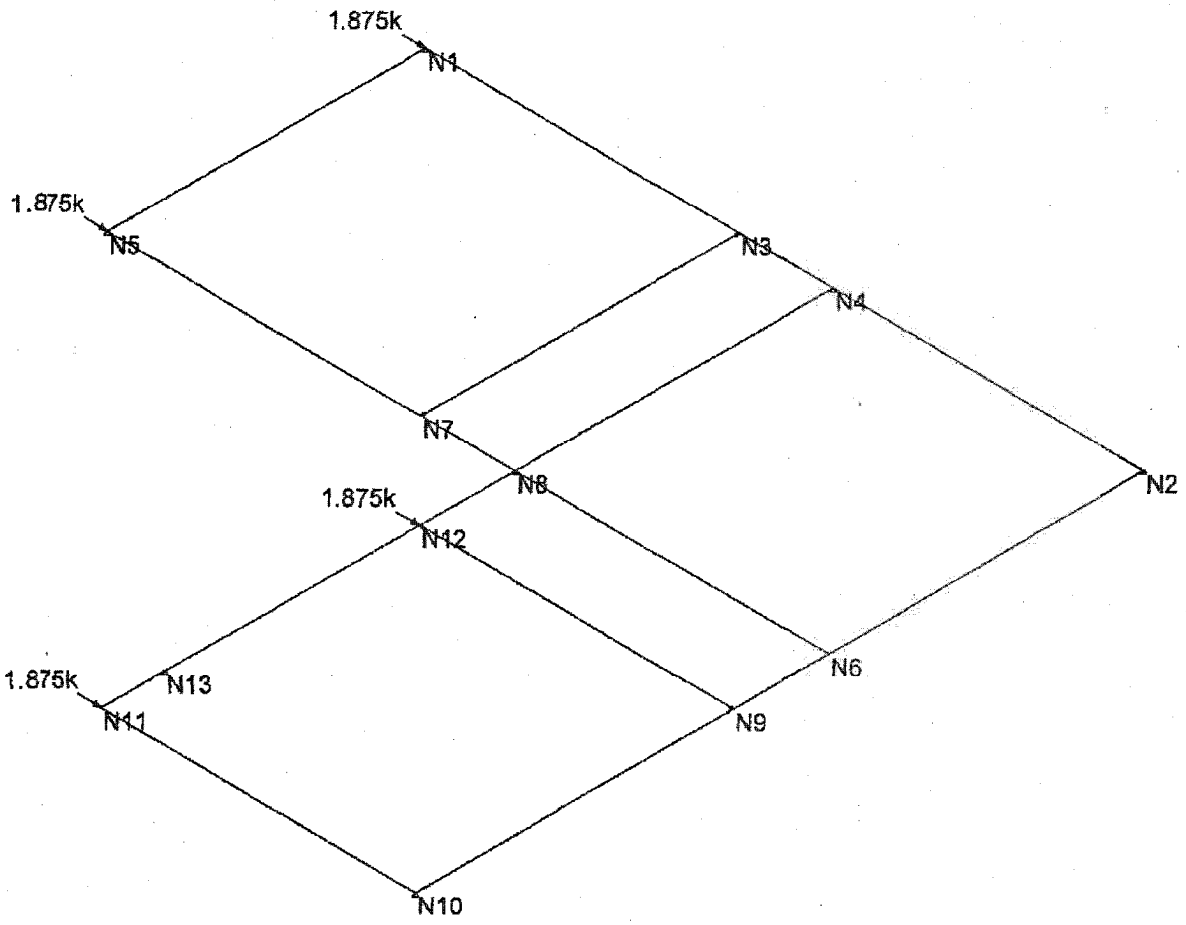
(Checking lateral bending for span)

As	0.620 in^2
rho	0.002331
np	0.06008
k : (np^2+2np)^.5-np	0.2917
j = 1 - k/3	0.9028
M:mas=Fb k j b d^2/2	16.379 k-ft
M:Stl = Fs As j d	9.305 k-ft



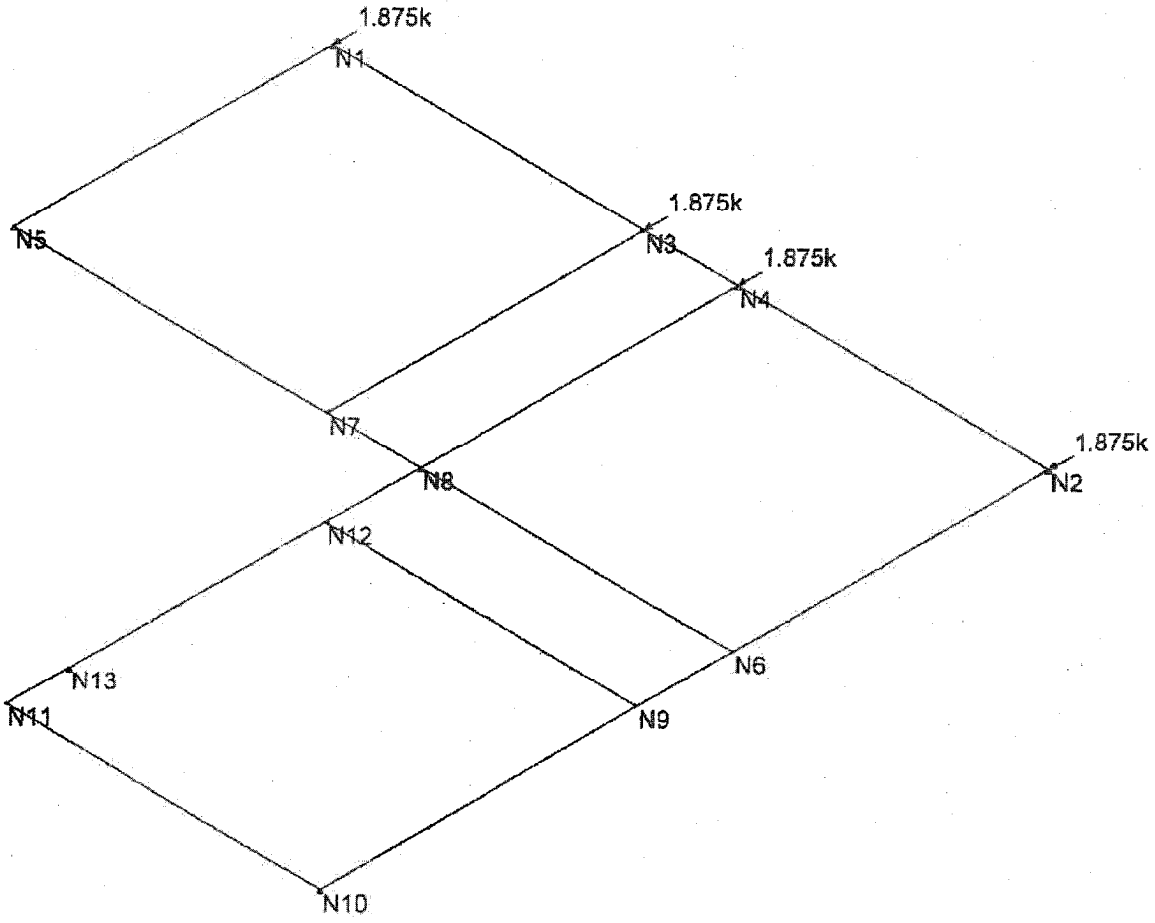
Loads: BLC 2, Dead - mech
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 1
BKN		Oct 26, 2015 at 10:51 AM
14-1298		14-1298 - City of Glendale_Cooling...



Loads: BLC 3, Wind - X
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 2
BKN		Oct 26, 2015 at 10:45 AM
14-1298		14-1298 - City of Glendale_Cooling...



Loads: BLC 4, Wind - Z
Envelope Only Solution

Caruso Turley Scott, Inc.	City of Glendale - Cooling Tower	SK - 3
BKN		Oct 26, 2015 at 10:45 AM
14-1298		14-1298 - City of Glendale_Cooling..

Envelope AISC 14th(360-10): ASD Steel Code Checks

	Member	Shape	Code Check	Lo...	LC	She...	Lo...	...	...	Pnc/om [k]	Pnt/o...	Mnyy/...	Mnzz/...	Cb	Eqn
1	MEMBER 1	W12x40	.089	12...	6	.073	12...	y	3	87.016	350.2...	41.916	142.2...	1.8...	H1-1b
2	MEMBER 4	W12x40	.254	14...	3	.079	23	y	2	87.016	350.2...	41.916	97.421	1.2...	H1-1b
3	M3	W12x40	.028	0	2	.015	5	z	2	264.926	350.2...	41.916	142.2...	1.1...	H1-1b
4	MEMBER 3	W12x40	.050	7.6...	3	.044	21...	y	3	87.016	350.2...	41.916	142.2...	1.9...	H1-1b
5	MEMBER 2	W12x40	.194	10...	6	.090	10...	y	2	87.016	350.2...	41.916	142.2...	1.9...	H1-1b
6	M6	W12x40	.010	0	6	.003	1.7...	y	2	264.926	350.2...	41.916	142.2...	1.1...	H1-1b
7	M7	W12x40	.004	5	3	.004	10	y	2	264.926	350.2...	41.916	142.2...	1.1...	H1-1b
8	M8	W12x40	.004	5	2	.004	10	y	3	264.926	350.2...	41.916	142.2...	1.1...	H1-1b

10K

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1
3	A992	29000	11154	.3	.65	.49	50	1.1	65	1.1
4	A500 Gr.42	29000	11154	.3	.65	.49	42	1.4	58	1.3
5	A500 Gr.46	29000	11154	.3	.65	.49	46	1.4	58	1.3

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Ru...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Column	HSS8x8x6	Column	SquareTube	A500 Gr.46	Typical	10.4	100	100	160
2	Beam	W12x40	Beam	Wide Flange	A992	Typical	11.7	44.1	307	.906
3	Brace	L4x4x4	Column	Single Angle	A36 Gr.36	Typical	1.93	3	3	.044

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	MEMBER 1	N1	N2			Beam	Beam	Wide Flange	A992	Typical
2	MEMBER 4	N2	N10			Beam	Beam	Wide Flange	A992	Typical
3	M3	N10	N11			Beam	Beam	Wide Flange	A992	Typical
4	MEMBER 3	N11	N4			Beam	Beam	Wide Flange	A992	Typical
5	MEMBER 2	N6	N5			Beam	Beam	Wide Flange	A992	Typical
6	M6	N5	N1			Beam	Beam	Wide Flange	A992	Typical
7	M7	N7	N3			Beam	Beam	Wide Flange	A992	Typical
8	M8	N12	N9			Beam	Beam	Wide Flange	A992	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	23	0	0	0	
3	N3	10	0	0	0	
4	N4	13	0	0	0	
5	N5	0	0	10	0	
6	N6	23	0	10	0	
7	N7	10	0	10	0	
8	N8	13	0	10	0	
9	N9	23	0	13	0	
10	N10	23	0	23	0	
11	N11	13	0	23	0	
12	N12	13	0	13	0	
13	N13	13	0	21	0	

Member Distributed Loads (BLC 2 : Dead - mech)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	MEMBER 1	Y	-.6	-.6	0	0
2	MEMBER 2	Y	-.6	-.6	0	0
3	MEMBER 3	Y	-.6	-.6	0	10
4	MEMBER 4	Y	-.6	-.6	13	233

9k·1.2 = 10.8k/2 10.8k/2 = 5.4k
5.4k/9' = .6k

Joint Loads and Enforced Displacements (BLC 3 : Wind - X)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N1	L	X	1.875
2	N5	L	X	1.875
3	N12	L	X	1.875
4	N11	L	X	1.875

Joint Loads and Enforced Displacements (BLC 4 : Wind - Z)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N1	L	Z	1.875
2	N3	L	Z	1.875
3	N4	L	Z	1.875
4	N2	L	Z	1.875

29.7·(14'·9'/2) = 1.875

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Me...	Surface(P...
1	Dead	DL		-1						
2	Dead - mech	DL						4		
3	Wind - X	WLX				4				
4	Wind - Z	WLZ				4				

Load Combinations

	Description	So...	P...	S...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	DL	Yes	Y		1	1	2	1																
2	DL+.6WLX	Yes	Y		1	1	2	1	3	.6														
3	DL-.6WLX	Yes	Y		1	1	2	1	3	-.6														
4	.6DL+.6WLX	Yes	Y		1	.6	2	.6	3	.6														
5	.6DL-.6WLX	Yes	Y		1	.6	2	.6	3	-.6														
6	DL+.6WLZ	Yes	Y		1	1	2	1	4	.6														
7	DL-.6WLZ	Yes	Y		1	.6	2	1	4	-.6														
8	.6DL+.6WLZ	Yes	Y		1	.6	2	.6	4	.6														
9	.6DL-.6WLZ	Yes	Y		1	.6	2	.6	4	-.6														

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N5	max	1.118	3	2.407	3	.086	7	0	1	0	1	0	1
2		min	-1.118	2	1.444	8	-.086	6	0	1	0	1	0	1
3	N1	max	1.132	3	3.559	3	1.209	7	0	1	0	1	0	1
4		min	-1.132	2	2.136	9	-1.209	6	0	1	0	1	0	1
5	N8	max	.985	3	15.032	2	.557	7	0	1	0	1	0	1
6		min	-.985	2	9.019	8	-.557	6	0	1	0	1	0	1
7	N2	max	.03	2	4.288	3	1.067	7	0	1	0	1	0	1
8		min	-.03	3	2.573	4	-1.067	6	0	1	0	1	0	1
9	N10	max	.978	3	5.731	2	.014	2	0	1	0	1	0	1

Envelope Joint Reactions (Continued)

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
10		min	-.978	2	3.438	5	-.014	3	0	1	0	1	0	1
11	N4	max	.084	6	9.251	2	1.598	7	0	1	0	1	0	1
12		min	-.084	7	5.55	9	-1.598	6	0	1	0	1	0	1
13	N13	max	.356	3	4.588	3	.019	2	0	1	0	1	0	1
14		min	-.356	2	2.752	4	-.019	3	0	1	0	1	0	1
15	Totals:	max	4.5	3	44.855	2	4.5	7						
16		min	-4.5	2	26.913	4	-4.5	6						

foundation depth to match drilled piers for site wall 15'-0" min

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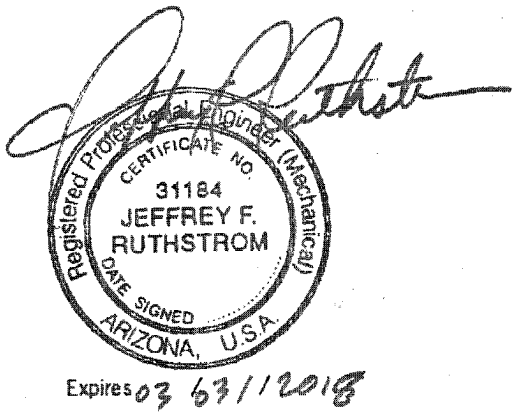
PEA No. 2015045



Expires 03/31/2018

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Labor, materials, tools, and services for a complete and operable installation of equipment and systems as applies to all sections included in Division 22 and Contract Documents.

B. Principal features of the work included are:

1. Patching of walls and floors to fit plumbing system components.

2. Plumbing systems and equipment including waste, vent, roof drainage, domestic water and devices.

3. Furnish anchor bolts, sleeves, supports and similar items to be built into concrete and masonry.

4. Preparation for testing and balance of plumbing systems and correcting deficiencies.

5. Preparation and submittal of shop drawings and product data.

6. Maintaining a record set of blueline prints and marking them to indicate locations of concealed items, and deviations made to suit conditions and production of mechanical as-built (record) drawings.

7. Preparation and submittal of the "Operations and Maintenance Manual" in accordance with Division 01 for Plumbing Systems.

8. Attendance of a pre-construction conference to occur within 15 days after award of contract. Representative and Superintendent for this project will be required to attend this meeting.

1.02 RELATED WORK

A. Division 01: Maintenance and operations manuals.

B. Division 03: Concrete (equipment pads, as may be required for items in Division 22 are not provided for by General Contractor).

C. Division 06: Rough Carpentry (wood blocking in walls required for attaching plumbing/mechanical items).

D. Division 07: Flashing and Sheet Metal (flashing for plumbing/mechanical items penetrating walls).

1. Section 07 14 00: Fracture Resistant Waterproof Membrane System.

E. Division 09: Painting.

F. Division 26: Electrical.

1.03 JOB CONDITIONS

A. Submittal of bid implies bidder has read applicable paragraphs of the specifications including the AIA General Conditions Document A201 and will be bound by their conditions.

B. The Plumbing Contractor shall have a minimum of five years' experience installing plumbing and piping systems, similar to those described in these specifications and provide a list to the Architect of five previous projects including name of project and contact person names and phone numbers as a separate document in addition to the plumbing bid or proposal submitted by the General Contractor.

C. The Plumbing Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Arizona as a Plumbing Contractor.

D. The Plumbing Contractor shall be able to bond work he is bidding to perform and shall provide a written statement to the Architect from the bonding agency proposed to be used for this project as a separate document in addition to the plumbing bid or proposal submitted by the General Contractor. The bonding agency proposed to be used by the Plumbing Contractor shall have a Best's insurance rating of A or A+.

1.04 LOCAL CONDITIONS

A. Coordinate with, and prior to submitting of bid, this Contractor shall verify all utility (gas, sewer and water) connections with the local utility company(ies) serving this project. Pay special attention to, but not necessarily limited to: invert elevations, size, pressure, other utilities in the area, etc... Include in bid price all costs for permits, bonds, tap fees, manholes, meter and/or backflow installations, etc...

B. Existing conditions and/or Facility/Utility: This Contractor shall coordinate in writing Seven (7) business days prior to start of work for any shut-down and/or removal of any existing condition(s). Coordination letter shall identify start/stop times (shut down time), and total manhours to perform all facets of necessary work. This coordination letter shall be submitted to the Architect.

1.05 EXAMINATION OF PREMISES

A. Visit the site before submitting a Bid or Proposal, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.06 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01.

B. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01.

1.07 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and all required offsets, bends, special fittings and exact locations are not indicated.

Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear. Notify Architect of any special building conditions and special building areas in which the drawings conflict as to the fit of ductwork, piping or equipment. This notification shall occur in written form (such as an 'RFI'), prior to the installation of any work in these special areas.

This notice shall occur prior to the purchase and/or shipment of equipment to the job site for these areas. The Architect shall effect an alternate relocation of the ceiling, duct, or piping to avoid installing materials more than one time.

1.08 EXISTING MATERIALS AND EQUIPMENT

A. General: Certain items of plumbing equipment, piping, etc., are to be removed as indicated on the drawings. Certain of these items are to be reused where indicated.

B. Disposition: With the exception of items which are to be reused or retained by the Owner, all other materials shall be removed and disposed of by the Contractor.

C. Unused Materials: All unused piping, controls and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling.

D. Exterior Services: The Contractor shall be responsible for maintaining service to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Owner.

E. Continuity of Services in Existing Building: Contractor shall permanently reroute existing services or provide temporary connection as required to maintain service to existing fixtures in building which are to remain in service. All temporary outages shall be coordinated with the Owner's representative.

F. Rerouting and Relocation of Existing Plumbing Equipment and Services in Existing Building: General Contractor shall reroute, relocate all existing plumbing work which is in conflict with the building alterations and which is required to be maintained in use.

G. Existing Piping: Where applicable, as noted on plans and as approved, existing material may be reused in their original location unless otherwise noted or shown.

1.09 INTENT

A. The contract documents (drawings, plans and specifications) describe the plumbing work of this project. Any item mentioned in one part shall be as binding as though mentioned in all parts.

B. The contract documents form a guide for a complete and operable plumbing installation. Where an item is reasonably necessary but not specifically mentioned, such as pipe hangers or transitions, piping offsets, drains, vents, etc., for a complete system, provide same as if were specified.

C. Plumbing system layouts indicated on drawings are diagrammatical only. Exact locations of pipes, and equipment shall be coordinated with related trades prior to installation of any work. Also these locations shall be coordinated with the Engineer/Architect for evaluation regarding future building needs. This relocation/rerouting review (if required) shall occur prior to actual work bring.

D. The Engineer shall not be responsible for the means, methods, procedures, techniques, or sequences of construction, nor for safety on the job site, nor shall the Engineer be responsible for the contractor's failure to carry out the work in accordance with the contract documents.

E. Compliance by the Contractor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically suited to meet operating guarantees at the specified service conditions.

1.10 DEVIATIONS

A. Deviations from specifications and drawings shall not be made without full knowledge and written consent of the Owner.

B. Contractor shall report all items discovered during construction that require deviation from the Contract Documents. See Division 01 for procedures.

1.11 QUALITY ASSURANCE

A. Comply with applicable local, state and federal codes.

B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades. (See individual Section of Division 22.)

C. Employ only qualified journeymen for this work. Employ competent, qualified mechanics to supervise the work.

1.12 CODES AND STANDARDS

A. Perform work specified in Division 22 in accordance with codes and standards listed below, and such standards that may be specified in other sections. When these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the Architect.

1. NFPA 101: Life Safety Code.

2. 2012 International Building Code with City of Glendale Amendments.

3. 2012 International Mechanical Code with City of Glendale Amendments.
4. 2012 International Plumbing Code with City of Glendale Amendments.
5. 2011 National Electric Code.
6. ANSI Handicapped Code-A117.1.
7. ANSI: American National Standards Institute.
8. ARI: American Refrigeration Institute.
9. ASHRAE: American Society of Heating Refrigeration and Air Conditioning.
10. ASME: American Society for Mechanical Engineers.
11. ASTM: American Society for Testing and Materials.
12. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
13. NEMA: National Electrical Manufacturers' Association.
14. NFPA: National Fire Protection Association.
15. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
16. UL: Underwriters' Laboratories, Inc.
17. CISPI: Cast Iron Soil Pipe Institute.
18. ADA: Americans with Disabilities Act.
19. FM: Factory Mutual.

1.13 COORDINATION

A. Carefully examine specifications and drawings to be thoroughly familiar with items which require plumbing connections and coordination.

B. Coordinate with other Divisions to leave proper chases and openings. Place outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

1.14 SUBMITTALS

A. In the case of substitution the Contractor shall include clearly marked engineering data on both the specified items and the proposed substitute items.

B. Submit items to the Architect. Submittals are only required for specific items of equipment or material listed in individual sections of these specifications.

C. Within 15 days after award of contract for this work, submit a complete list of proposed manufacturers from all individual sections of the Division 22 Specification (of equipment or material to be used) for approval by the Architect/Engineer.

Submit this list before submittal of shop drawings and product data, and obtain approval before submitting items listed below. If Architect/Engineer does not approve a proposed manufacturer, then coordinate with him in selecting another manufacturer who does meet with his approval.

D. Shop Drawings: Within 30 days after award of Contract for this work. Submit one reproducible of shop drawings of ductwork, piping, and equipment and seven copies of product brochures as required from all individual sections of the Division 22 specification at one time in a 3-ring binder; one complete binder for all plumbing items indexed and separated by dividers, one binder for all plumbing items, one binder for all fire protection items. Partial submittals will not be accepted.

E. Brochures: Submit seven copies of manufacturer's brochures including:

1. Complete descriptions.
2. Illustrations.
3. Specifications data of materials, and operating rates, fan curves, weights, electrical characteristics, etc.
4. Where items other than those proposed for use are illustrated and/or described on the same brochure pages, clearly indicate the items proposed for use.

F. Any piece of equipment placed on the job without prior written review shall be subject to removal.

1.15 OPERATING AND MAINTENANCE MANUALS

A. Three sets of the following data are required:

1. Operating and maintenance instructions prepared in accordance with Division 01 (Usually Section 017823) of these specifications.
2. Spare parts lists.
3. Illustrated parts breakdown for each piece of equipment.
4. Copies of approved submittal data.
5. Local supply house name and address, local supply house phone number and contact person for each item of equipment for future parts procurement. Also include National and/or Regional Headquarters phone number.
6. Equipment warranties.
7. Water balance report.
8. Control wiring diagrams, operating sequences, and devices literature.
9. All programmable logic documentation.

10. All as-built record drawings.

11. Valve tag identification chart.

B. Arrange each set of data in an orderly way, and bind each set in a separate three-ring, hard cover binder.

C. Two weeks prior to substantial completion of the project deliver three complete sets to Architect to be used for the Owners training of equipment operating personnel.

1.16 DELIVERY AND STORAGE

A. Deliver items in manufacturer's original unopened packaging. Cover items with protective materials to keep them from being damaged (physical and weather).

B. Store items in a clean, dry place, and protect from damage which may be caused by theft, the weather, and/or all building and construction operations.

C. All flange facings shall be protected by securely fastened durable covers to prevent damage during shipment.

D. Exposed finished and machined surfaces, including bolting, shall be given a heavy coating of rust-inhibiting compound. Internal metal surfaces shall be sprayed or coated with a suitable rust preventative which is strippable.

E. Bearings, bearing housings, and oil systems, including reservoirs, coolers, filters, and piping, shall be thoroughly cleaned internally of metal particles, dirt and debris, and coated with a suitable rust preventative prior to shipment.

F. All instruments and valves, including auxiliary systems, must be securely mounted and/or supported to eliminate damage during shipment, storage, operation, and maintenance.

G. Supports and rigging connections shall be provided to prevent damage during transit, lifting or unloading.

H. Threaded connections shall be provided with a pipe plug of the same material as the connections (except cast iron connections shall have steel plugs). Plugs shall have a square or hex head. Teflon tape shall be used as a thread sealant.

I. Open ends of tubes and pipe shall be capped (just taping is not adequate) for protection.

1.17 GUARANTEE

A. Guarantee all material, equipment, and workmanship for all sections under Division 22 in writing to be free from defects of material and workmanship for a minimum of one (1) year from date of final acceptance by the Owner or substantial completion. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Acceptable Manufacturers: In general see individual sections of these specifications.

B. Within the Contract Documents relating to mechanical work, manufacturers' names, catalog numbers, and other proprietary references to materials and equipment are made. Such references are made to establish the standards of quality and type required, and not to limit competition. Most known or acceptable manufacturers of competitive products are listed in applicable sections as "Acceptable Manufacturers". Reasonable requests for substitution or additions to "Acceptable Manufactures" will be considered, but the Architect will be the sole judge of acceptability of items proposed as substitutes.

C. Materials and equipment used in carrying out these specifications shall bear UL or other codes and standards, listed in Section 1.12, recognized testing laboratory label.

D. Where substitutions are desired, comply with the requirements of Division 01, Substitutions and Product Options.

2.02 PIPE AND VALVE MARKERS

A. This Contractor shall prepare a chart or diagram for each piping system, indicate by number each valve in the system and each valve's location, function, and whether normally open or normally closed. Numbers used on valves shall correspond with chart.

B. Acceptable Manufacturers: Seton, Westline, Brady.

C. Pipe markers: Seton Model, "Setmark" Series pipe markers with directional flow arrows (where required), and the applicable ANSI/OSHA pipe name and color scheme.

D. Valve Markers: Brass, aluminum or plastic disc not less than 1-1/4" diameter and bearing engraved numbers corresponding to those shown on chart and fasten to valve with No. 16 zinc plated steel jack chain. Lettering shall be a minimum 1/2" in height.

2.03 SUPPORTS, ANCHORAGE AND RESTRAINTS

A. General

1. When supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping and ductwork are not shown on the Drawings, the Contractor shall be responsible for their design.

2. Seismic restraints and anchorages shall resist seismic forces, as specified in latest edition of the International Building Code, for the seismic zone specified above.

3. Seismic restraints shall not introduce stresses in piping or ductwork caused by thermal expansion or contraction.

4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Suspended Piping: Seismic restraints shall be in accordance with the latest edition of the SMACNA "Seismic Restraint Manual - Guidelines for Mechanical Systems" for the Seismic Hazard Level (SHL) as specified above.

C. Submittal Requirements:

1. Suspended piping: Submit shop drawings of piping and ductwork indicating point loads and seismic restraint locations, along with applicable details keyed to layouts.

2. Support frames, equipment supports, and anchorage: Submit shop drawings indicating point loads and seismic restraint locations, along with Engineer's calculations and details keyed to the layouts pertaining to support frames, anchorages, and seismic restraints.

2.04 SDWA – SAFE DRINKING WATER ACT

A. General

1. All potable water components installed on this project shall meet or exceed the requirements of the SDWA in all respects. This requirement reduces the permissible levels of lead in the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures to a weighted average of not more than 0.25%. The 0.20% lead limit for solders and flux first implemented in 1986 and stipulates a method for calculating the weighted average lead content is required as well on this project. Products that meet this standard are referred to in the SWDA law as "Lead Free."

2. All products on this project shall be certified by an independent third-party laboratory and certifying that is listed to NSF 61 Standards.

3. Piping, pipe fittings, plumbing fittings and fixtures that are installed on this project that are installed that do not meet or exceed the SDWA will be required to be removed at the Contractor's expense and replaced with an approved SDWA product.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment installations shall be in accordance with the requirements and recommendations of the equipment manufacturer.

3.02 LOCATIONS

A. Plumbing layouts indicated on drawings are diagrammatical. Exact locations of pipes, and equipment may vary because of conflicts with work of other trades. Work out conflicts where relocations will not affect operation or appearance of systems prior to installing any equipment, or piping. Also, these locations shall be coordinated with the Engineer/Architect for evaluation regarding future building needs.

B. Locate equipment requiring periodic servicing so that it is "readily accessible". Do not back up service sides to walls, nor place it too close to other equipment making service

impractical. Coordinate with manufacturer's recommended equipment placement guidelines to determine maintenance access required.

C. All equipment and appurtenances shall be installed in accordance with the requirements of the manufacturer.

3.03 CUTTING AND PATCHING

A. Cut and patch per Division 1 as necessary to properly install the work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect.

B. Repair or replace routine damage caused by cutting in performance of contract.

C. Correct unnecessary damage caused due to installation of plumbing work.

D. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.04 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.05 COUNTER FLASHING

A. Counter-flash pipes, etc., at penetrations of outside walls.

3.06 CONNECTION TO EQUIPMENT

A. Connect or install equipment shown on plumbing drawings that requires plumbing and/or mechanical hookups.

B. Rough-in piping and connect equipment.

C. Provide piping, shutoff valves, drain valves and unions as required for a complete and serviceable operable installation.

D. Provide flexible connections to all rotating or vibrating equipment unless otherwise noted or detailed.

3.07 SERVICE OF SYSTEMS

A. If equipment is placed in service prior to acceptance of the project by Owner, operate equipment strictly in accordance with manufacturer's instructions.

1. Employ competent, qualified personnel in operation of the equipment.

2. Provide for proper operation and cleanliness. Provide temporary filters in all air handling equipment.

3. Open up equipment for inspection as directed by the Architect. Provide a clean set of filters installed after final acceptance of the building by the Architect.

B. Lubricate equipment and perform such other maintenance as required to place it in optimum operating condition.

3.08 PIPE, VALVE AND CONTROLS MARKING

A. Pipes:

1. In equipment rooms and above accessible ceilings, install bands adjacent to each tee and at 10-foot intervals on straight runs.

2. In furred spaces place bands adjacent to each valve, at each tee, and 12 inches above and below floor at risers.

3. Where exposed in rooms other than equipment rooms, place bands at points of entrance and exit into room, adjacent to each valve visible in the room and at 20 Foot intervals.

4. Identify pipe with verbiage, directional arrows and the following "ANSI/OSHA" colors:

SERVICE	BACKGROUND LETTERS	COLOR
Domestic Cold Water	Green	White
Soil and Drains	Green	White
Vent Pipe	Green	White

5. Mount one of each chart in every equipment room. Mount each chart in aluminum frame with clear glass front and secure to wall where directed by Architect or Owner's Representative.

6. Bind copies of each chart in "Operations & Maintenance Manual".

B. Instrument and Controls

1. Identify all panel-mounted instruments and controls with engraved bakelite nameplate permanently affixed to panelboard.

2. Identify all damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape, affixed to controller indicating service and, where applicable, normal setting.

C. Valves

1. Provide each valve with unique number associated to valve chart (as described in Section 2.02 of this specification section).

3.09 ACCEPTANCE OF SYSTEMS

A. Complete the following before requesting a final inspection:

1. Work required under this division of specifications except as permitted. Special attention shall be paid to completion of work required under Section 22 05 10.

2. System balancing.

3. Control system checkout.

4. Furnish required operating instructions, wiring diagrams, and electric "project record document" control diagrams in accordance with Division 01 within a frame with glass face and mount one copy of each in the equipment rooms and as specified elsewhere.

5. Architect will accept job on basis of tests and inspections. A representative of the firm that performed test and balance work is to be in attendance to assist, and Contractor is to furnish necessary mechanics to operate system, make any necessary adjustments, and assist with final inspection.

6. The Contractor shall be responsible for proper operation of all systems, minor subsystems, and services provided under this Section. He shall coordinate startup procedures, calibration, and system checkout with all subcontractors involved. Any system operational problems shall be diagnosed; all correctional procedures shall be initiated with the various subcontractors as required to bring the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally. Any remaining difficulties shall be brought to the attention of the Engineer.

7. Thoroughly clean all parts of the installation at the completion of the work. The Contractor shall clean up and remove from the premises all refuse material, crates and rubbish arising from his Work. Remove, clean, and reinstall all filters. Belt-drive tensions and alignments shall be checked. All motors and bearings shall be lubricated in accordance with the manufacturer's service manuals prior to equipment startup. Provide a lubrication schedule for every item of equipment furnished under this Section. The schedule shall include the type of lubricant and the application frequency.

END OF SECTION 22 05 00

SECTION 22 05 10

CLEANING PLUMBING SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Comply with provisions of Section 22 05 00.

B. Cleaning plumbing systems equipment and piping.

C. Cleaning domestic water systems equipment and piping.

D. Cleaning waste and vent systems equipment and piping.

1.02 RELATED WORK

A. Section 22 05 00: Common Work Results for Plumbing

B. Section 22 11 16: Piping and Fittings

1.03 SUBMITTAL

A. Submit seven (7) copies of Water Analysis and Test copies from Arizona State Certified Laboratory.

PART 2 PRODUCTS

2.01 NOT APPLICABLE

PART 3 EXECUTION

3.01 DOMESTIC WATER SYSTEM

A. Clean domestic water piping after cutting or reaming.

B. Flush system progressively by opening building operable valves, faucets and hose bibbs and permitting flow to continue from each until water runs clear.

C. Sterilization/Disinfection: Disinfect/Sterilize the entire water distribution system thoroughly with a solution containing not less than 50 parts per million of available chlorine. For the chlorinating material use sodium hypochlorite solution, conforming to Federal Specification 0-8-441, Grade D, and introduce into the system in according with American Water Works Association (AWWA) Standard 601 or a manner approved by the Architect. Allow the sterilizing solution of no less than 25 parts per million to remain in the system for a period of 24 hours, during which time all valves and faucets shall be opened and closed several times.

After the disinfection process is complete, the water containing residual chlorine should be flushed from the system with potable water, and water samples collected for bacteriological examination. The Contractor will use the following procedures for conducting bacteriological testing:

1. Submit water samples to an Arizona State certified laboratory.

2. The Contractor will ensure analysis of drinking water is by the presence/absence method with ortho-nitrophenyl-B-d-galactopyranoside/4-methyl-umbelliferyl-B-d-glucuronide (ONPG/MUG) media. The water must be analyzed on-site for pH and chlorine residuals. The samples will be analyzed for total and fecal coliform, cultured the date of receipt at the laboratory, and read 24 hours later.

3. The Contractor will use chain of custody records, and submit these records along with the analytical report to the Architect. The analytical report will include on-site pH and chlorine residuals, and results of total and fecal coliform testing. The Contractor shall provide telephone notification to the Architect immediately following a detection of contaminant concentrations that exceed the Arizona or EPA maximum contaminant level (MCL). Prior to resuming use, the Contractor will disinfect any existing main, standpipe, reservoir, tank, or other pipe or structure through which water is delivered to consumers after cleaning, repairing or cutting into this structure.

After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million, unless otherwise directed. Note: Contractor shall provide the Architect with certification of test results.

3.02 WASTE AND VENT PIPING SYSTEM

A. Verify all waste and vent piping system is free of debris prior to running water into any drain piping. Flush all plumbing fixtures in the presence of the Architect. Run faucets or showers a minimum of 5 minutes on full open for all fixtures in the presence of the Architect.

3.03 FACTORY FINISHES

A. Clean items with factory finishes.

B. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula.

C. If finishes are damaged to any extent, including but not limited to scratches and unfinished spots, refinish the entire item. Architect will be the judge of whether refinishing is required.

3.04 GENERAL CLEANUP

A. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Architect.

B. Stainage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.

END OF SECTION 22 05 10

SECTION 22 05 15

TESTING PLUMBING SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

B. Test mechanical systems and equipment to demonstrate proper operation.

1.02 RELATED WORK

A. Section 22 05 00: Common Work Results for Plumbing.

B. Section 22 05 10: Cleaning Plumbing Systems.

C. Section 22 11 16: Piping and Fittings.

1.03 SUBMITTALS

A. Submit Air and Water Balance Agency data in accordance with Section 23 05 93.

1.04 QUALITY ASSURANCE

A. Employ a reputable, AABC or NEBB certified air balance contractor regularly engaged in the work to test and balance plumbing systems in accordance with Section 23 05 93.

1.05 COORDINATION

A. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. All instruments used by the Water Balance Contractor shall be accurately calibrated within the past calendar year and maintained in good working order.

B. All instruments used for testing purposes shall be provided and operated in that the design system parameters fall within the mid-range of the testing apparatus, and the range shall be such that pressure differential can be read in minimum 1% increments of the actual test pressure.

PART 3 EXECUTION

3.01 TESTING - GENERAL

A. Test systems and equipment installed to demonstrate proper operation.

B. Submit notices of readiness for testing to Architect and other appropriate people.

C. Correct and retest work found defective when tested.

D. Make repairs to piping systems with new materials. Peening, doping or caulking of joints or holes will not be acceptable.

3.02 DOMESTIC WATER PIPING

A. Test cold water piping systems upon completion of rough-in, before fixtures are connected, at a hydrostatic pressure of 125 PSIG for a period of four hours with no loss in pressure.

3.03 DRAINAGE AND VENT SYSTEM

A. Test plug opening to permit system to be filled with water, and subject system to 10 foot head of water pressure. System shall hold water for four hours with no drop in water level and without visible leakage.

B. System may be tested in sections. A 10 foot head is the minimum pressure allowable for conducting tests.

3.04 RECORDS OF TESTING

A. Maintain records of all system testing and results thereof.

B. Deliver records of system testing to Architect as part of the maintenance and operation manual.

END OF SECTION 22 05 15

SECTION 22 05 23

VALVES

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

B. Contractor shall provide and install valves of every kind for all Division 22 plumbing piping systems as specified herein and as indicated on the drawings, complete with all unions, supports, hand wheels and accessories necessary for fully functional piping systems.

C. For the purpose of establishing the quality and configuration of the valve required, a manufacturer's name and figure number is given hereinafter. Valves of equal quality by other manufacturers, which conform to these specifications, may be submitted for review by the Engineer in accordance with the "submittal section of specification section 22 05 00".

1.02 RELATED WORK

A. Section 22 05 00: Common Work Results for Plumbing.

B. Section 22 05 15: Testing Plumbing Systems.

C. Section 22 11 16: Piping and Fittings.

D. Section 22 07 00: Plumbing Insulation.

1.03 SUBMITTALS

A. Submit seven copies of all valves for review by the Architect.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ball Valves: Apollo, Hammond, Nibco and Grinnell, Milwaukee, Plast-O-Matic, Hayward, Asashi American.

B. Gate, Globe and Check Valves: Nibco, Milwaukee, Hammond and Grinnell.

C. Hose Bibb: Woodford, Acorn, Zurn, Smith, Wade.

2.02 **All valves installed on domestic water system** shall be "Full Bore" type with working parts of non-corrosive material. (No butterfly valves shall be installed in domestic water systems).

2.03 VALVES

A. Gate Valves:

1. Gate Valves - 2-1/2" - 3" (For valves 2" or smaller see Ball Valve): Hammond #IB647, 125# SWP solder joint; body and bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper-silicon alloy stem, brass packing gland, and malleable hand wheel.

2. Gate Valves - 4" and larger: Hammond #IR1138 shall be Class 125 iron body, bronze trimmed, with body and bonnet conforming to ASTM A-126, Class B cast iron, 125 lbs., flanged ends, and two-piece packing gland assembly.

B. Non-Slam Check:

1. Size 2" and Smaller: 150 psi SWP bronze body, bronze trim, Hammond #IB945 or approved equal.

2. Size 2-1/2" and Larger: ASTM A126-Class B, 125 psi SWP, non-slam check valve with bronze disc, stainless steel pin, Hammond #IR1124 or approved equal.

C. Globe Valves:

1. Globe Valves (2" and less): Hammond #IB418, 125# SWP solder joint, body and bonnet of ASTM B-62 bronze composition, copper-silicon-bronze stem, brass packing gland, and malleable hand wheel.

2. Globe Valves (2-1/2" and larger): Hammond #IR116, Class 125, iron body, bronze trimmed, with body and bonnet conforming to ASTM A-126, Class B cast iron, flanged ends, and two-piece packing gland assembly.

D. Ball Valves (2" and Smaller): Provide Hammond #8614 (Solder ends), or #8604 (Threaded ends), full port three-piece bronze ball valves. Provide with blowout-proof stems, chrome-plated brass ball and stem extension for insulation clearance (where required).

E. Backflow Preventers: Refer to Drawings.

F. Hose Bibbs: Provide with integral vacuum breaker, T-handle, freeze proof length operator for cities other than Phoenix metro area, non-freeze proof length for Phoenix metro area.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate valves so as to be accessible by maintenance personnel. Provide wall and/or ceiling access panels as may be required to make accessible.

B. Install accessible valve and union at each equipment connection.

C. Coordinate location of valved outlets for mechanical equipment with Mechanical Contractor.

D. Install chrome-plated escutcheon plates at all wall, floor and ceiling penetrations.

E. Install shutoff valve at piping entry into the building where indicated on the drawings. Building valve must be full way pattern gate valve.

F. Install all valves per manufacturer's written instructions.

G. Stem valves must be installed upright or no greater than 90° from upright on horizontal piping.

H. All valves installed shall be line size, full port as indicated herein, or as indicated otherwise on the drawings.

I. On all valves with solder ends Contractor shall (at a minimum) make sure that the valve is in the open position prior to soldering. If possible and practical, Contractor shall remove non-metallic seat material prior to soldering procedure.

END OF SECTION 22 05 23

SECTION 22 05 29

PIPE HANGERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

B. Contractor shall provide and install pipe hangers and supports for various types of pipe installed as set forth in this section and related sections.

C. Contractor shall provide all intermediate and/or supplementary support steel attached to building structure for piping systems as necessary for support of all piping systems. Attachment of supplementary steel shall be as recommended by building Structural Engineer.

D. When supports, anchorages, and/or seismic restraints for piping are not shown on the drawings, the Contractor shall be responsible for their design and installation.

E. Seismic restraints and anchorages shall resist seismic forces as specified in the latest edition of the International Building Code, for the seismic zone that this project is installed in.

1.02 RELATED WORK

A. Section 22 11 16: Piping and Fittings.

B. Section 22 07 00: Plumbing Insulation.

1.03 SUBMITTALS

A. Submit seven copies of manufacturer's product data for review by the Architect.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers and Supports: Anvil, Fee and Mason, Elcen, Michigan, Kin-Line, Unistrut.

B. Metal Framing Systems (as may be required): Anvil, Unistrut, Superstrut, and Kin-Line.

2.02 HANGERS

A. Anvil Figure 260 MSS Type 1, with adjustable clevis hangers, use these for:

1. Non-insulated pipe 2" through 24" diameter.

B. Anvil Figure 260 adjustable wrought clevis hangers, with Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8 foot intervals). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption.

Use these for:

1. Insulated steel pipe ½" through 24" diameter.

2. Insulated galvanized steel pipe ½" through 24" diameter.

3. Insulated copper pipe ½" through 8" O.D.

C. Anvil Figure 104, MSS Type 6, with adjustable swivel ring, split ring fire sprinkler piping hangers shall be UL/FM listed. Use this hanger type for:

1. Non-insulated steel pipe, galvanized steel pipe, and copper pipe ½" through 1-1/2" diameter with 6" long double wrapped poly tape on copper pipe at hanger locations.

2. Non-insulated cast iron soil pipe up through 8" diameter.

D. Anvil Figure CT-69, MSS Type 10, with adjustable swivel ring hanger, either plastic covered or copper plated for non-insulated copper tubing with no longitudinal movement. (Note: Contractor may poly tape copper pipe at hanger locations, 6" long, and double thick layer).

E. Anvil Figure 171, MSS Type 41 pipe roller, and Anvil Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8 foot intervals). Support piping on outside of insulation. Provide rod size as per manufacturer's recommendations. Size hangers so that pipe insulation passes through them without interruption. Use these for piping subjected to longitudinal movement:

1. Insulated copper pipe, ½" through 2-1/8" diameter.

2. Insulated steel pipe, 1" through 30" diameter.

F. Anvil Figure CT-121C, MSS Type 8, riser clamps (at floor slab penetrations), use these to support: Copper pipe risers.

G. Anvil Figure 261, MSS Type 8, riser clamps (at floor slab penetrations), use these to support: Steel pipe risers.

H. Trapeze Hangers: Where there are three (3) or more lines of pipe run parallel, support them with trapeze hangers as indicated below:

1. Pipe Size ½" through 4" - No longitudinal movement: "Unistrut" Series #P1001 double channel (length as required - Not to exceed 60"), hanger rod as required for largest pipe size on trapeze, secure pipes with "Unistrut" Series #P2000 pipe/tubing clamps.

   Note: For copper piping provide "Unistrut - Unicushion" isolation material or double wrap copper pipe with "poly" tape, 6" in length at support.

2. Pipe Size ½" through 4" (piping subjected to longitudinal movement): "Unistrut" Series #P1001 double channel (length as required - not to exceed 60"), hanger rod as required for largest pipe size on trapeze. Mount piping on "Unistrut" Series #P2474-1 pipe roller assembly. (Pipe roller to be secured to

channel as required per manufacturer's recommendations).
Note: For copper piping provide "Unistrut - Unicushion" isolation material or double wrap copper pipe with "poly" tape, 8" in length at roller assembly.

3. If insulated pipe, provide as indicated above, except Contractor to provide/install "Anvil" Series #167-MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 PSI). Support piping on outside of insulation.

I. Concrete Inserts: Anvil Figure 282, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load, operating systems.

J. C-Clamps: Anvil Figure 86, MSS Type 23.

1. Use these for attaching hangers to steel beams.

2. Note: Welding hanger rods to steel members is not permitted. Drilling of structural steel is not permitted.

K. Malleable Beam Clamps: Anvil Figure 292, MSS Type 29. Use these for attaching hangers to wide flange beams.

L. Internally Threaded, Heavy-Duty, Steel Expansion Drop-in Anchor: Red Head Multiset II. Use these for attaching hangers to existing overhead concrete floors. Internally threaded anchors shall be reviewed for application with the Project Structural Engineer for applicability/spacing/concrete type/approval prior to installation of any anchors.

PART 3 EXECUTION

3.01 PIPE HANGERS

A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight of pipe.

1. Support pipe risers at regular intervals in pipe shafts in accordance with good practice.

2. Do not use perforated metal, strap iron, or band iron for any pipe support means.

3. Do not make offsets in hangers.

B. Allowable spacing of pipe hangers and rod sizes is listed below. Space hangers and brackets at close intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging.

C. Steel Pipe:

Pipe Size	Hanger Spacing	Rod Size
1/4" - 3/4"	6'-0" O.C.	3/8"
1" - 1-1/2"	6'-0" O.C.	3/8"
2" - 3"	10'-0" O.C.	1/2"
4" - 5"	10'-0" O.C.	5/8"

6" -	12'-0" O.C.	3/4"
7" - 14"	12'-0" O.C.	7/8"

D. Copper Pipe:

Pipe Size	Hanger Spacing	Rod Size
1/4" - 1/2"	5'-0" O.C.	3/8"
3/4" - 1"	6'-0" O.C.	3/8"
1-1/4"	6'-0" O.C.	3/8"
1-1/2" - 2-1/2"	8'-0" O.C.	1/2"
2-1/2"	8'-0" O.C.	1/2"
3" - 4"	10'-0" O.C.	5/8"
5" - 6"	12'-0" O.C.	5/8"

E. Cast Iron Pipe: Support at every other joint, unless over four feet (4'-o"), then support at every joint.

F. Install all clamps, concrete inserts, and steel drop-in anchors per manufacturer's written instructions.

G. Provide all intermediate support steel necessary to bridge joists or structural members and allow for pipe hangers or supports. Under no circumstances shall roof deck or X-Bracing between structural members be used to support piping systems.

H. General: secure all piping in place using approved hangers, supports and anchors designed to support the weight of the pipe, fluid and insulation. Arrange hangers to prevent transmission of vibration from the piping to the building structure, with hangers and supports designed to allow for expansion and contraction. All refrigerant and chilled water piping between outdoor and indoor air conditioning units and water chiller shall be isolated from structure and supports with a minimum of 3/8" thick neoprene enclosed in a minimum 3" long, 26 galvanized steel shield.

I. Pipe Support: Support piping at each change of direction, at ends of branches, at base and top of riser pipes and drops, and wherever necessary to prevent sags, bending or vibration. Spacing between hangers shall not exceed UMC and UPC recommendations. Provide approved pipe stand secured in a permanent manner with an adjustable support. Wood supports of any kind shall not be used.

Insulation Guards: Size hangers on insulated piping to fit outside the covering. Protect insulation from crushing at hanger locations with sheet metal pipe saddles. Use rigid insulation under saddle.

J. Allthread rod used at all suspension points shall be galvanized steel sized to properly bear the weight of the pipe segment.

K. No other piping system is to be attached to each suspension point. Other trades shall not join in attachment to these dedicated suspension or retained assemblies.

L. No attempt has been made to show all the required pipe supports in all locations, either on the drawings or in the details. The absence of pipe supports and details shall not relieve the Contractor of the responsibility for furnishing and installing them as required.

END OF SECTION 22 05 29

SECTION 22 05 53

PIPING IDENTIFICATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install pipe identification for all piping installed in this project.

PART 2 PRODUCTS

2.01 PIPE AND VALVE MARKERS

A. Acceptable Manufacturers: Seton, Setmark, Brady.

B. Pipe markers: Seton Model SNA or STR.

C. Valve Markers: Provide each valve with a brass, aluminum or plastic disc not less than 1-1/4" diameter and bearing engraved numbers corresponding to those shown on chart and fasten to valve with No. 14 brass wire.

PART 3 EXECUTION

3.01 PIPE, VALVE AND CONTROLS MARKING

A. In equipment rooms, install bands adjacent to each tee and at 10-foot intervals on straight runs.

B. In furred spaces place bands adjacent to each valve, at each tee, and 12 inches above and below floor at risers.

C. Where exposed in rooms other than equipment rooms, place bands at points of entrance and exit into room, adjacent to each valve visible in the room and at 20 Foot intervals.

D. Provide color code identification chart with aluminum frame and clear glass cover to mount on wall as directed. Provide copy of chart in Operating and Maintenance Manual.

E. Identify pipe with directional arrows and the following "ANSI/OSHA" colors:

SERVICE	COLOR	
	BACKGROUND	LETTERS
Domestic Cold Water	Green	White
Soil and Drains	Green	White
Vent Pipe	Green	White

F. Carefully prepare chart or diagram for each piping system, indicating by number each valve in the system and each valve's location and function. Numbers used on valves shall correspond with chart.

G. Mount one of each chart in every equipment room. Mount each chart in aluminum frame with clear glass front and secure to wall where directed.

H. Bind copies of each chart in Maintenance Manual.

I. Identify all panel-mounted instruments and controls with engraved bakelite nameplate permanently affixed to panelboard.

J. Identify all automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape, affixed to controller indicating service and, where applicable, normal setting.

END OF SECTION 22 05 53

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

B. Work required under this section consists of insulation for piping systems and equipment specified in Division 22.

C. Provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.

D. Certain equipment and/or systems to be factory insulated by the manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.

E. All pipe, fittings and valves to be insulated.

F. Thermal resistance "R" values used herein are expressed in units of hour/degrees F/sq. ft./Btu per inch of thickness on a flat surface at a mean temperature of 75 degrees F, unless specifically noted.

1.02 DEFINITIONS

A. "Exposed" equipment piping are areas which will be visible without removing ceilings or opening access panels. "Concealed" is not "Exposed."

B. Outdoors is considered exposed to the weather.

C. Underground is buried, whereas in a trench below grade is considered concealed.

1.03 RELATED WORK

A. Section 22 05 00: Common Work Results for Plumbing.

B. Section 22 11 16: Piping and Fittings.

1.04 APPLICABLE CODES AND STANDARDS

A. ASTM E-84.

B. NFPA 225.

C. UL 723.

D. NFPA 90A.

1.05 SUBMITTALS

A. Submit seven copies of all insulating materials data for review by the Architect.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. CertainTeed, Armstrong, Owens-Corning, Manville.

2.02 CERTIFICATION/QUALITY ASSURANCE

A. Only products of manufacturers meeting this specification will be approved.

B. Products shall meet applicable national, model, state and local building codes and be UL (or other recognized testing lab) listed for intended service.

C. All insulation materials shall be delivered and stored in manufacturer's containers and kept free from dirt, water, chemical, and mechanical damage.

D. All insulation, adhesives, coatings, sealers, tapes, shall have a flame spread rating of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E-84, NFPA 225, UL 723, and further must meet the requirements of NFPA 90-A where applicable and model and local buildings, plumbing codes.

E. Insulation for pipe, and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 2" thickness in less than 53 seconds when tested in accordance with ASTM D1692.

2.03 MATERIAL FOR PIPE

A. Materials for Pipe and Equipment: Provide factory premolded or shop or site metered segment type insulation for pipe, pipe fittings, and valves. Fitting insulation to be of same thickness and material as adjoining pipe insulation.

1. Flexible Tubular Elastomeric:

   a. Provide fire-retardant closed-cell slip-on flexible type similar to Armstrong Armaflex. Product to have continuous operational temperature limit of not less than 220 degree F and a minimum "R" value of 2.57.

   b. Seal all joints with vapor barrier mastic similar to Childers CP-30.

2. Glass Fiber:

   a. Provide factory-formed, fiberglass pipe insulated factory-jacketed system type similar to Manville Micro-Lok ASJ heavy density, one-piece, dual temperature, premolded insulation with temperature limit of 850°F.

   b. Insulate all valves, fittings and flanges with 3-pound density fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with premolded 25/50 rated PVC fitting, vapor sealed with Childers CP-30 vapor barrier mastic.

c. Jacket to be fiberglass reinforced white kraft paper bonded to aluminum foil.

d. The insulation shall be applied over clean, dry pipe with all joints butted firmly together.

e. All piping exposed to exterior shall be insulated with Manville Metal-Lok, CSG, Gustin-Bacon, Brower, Armstrong or approved. Insulation for exterior cold water piping shall be 2" thick.

1) The insulation shall be jacketed with a minimum thickness of 0.016" aluminum. The insulation and aluminum shall be secured in place by a continuous friction type joint to provide a positive weatherproof seal along the entire length of the aluminum jacket.

2) Then an aluminum preformed strap containing a permanently plastic weatherproof sealant shall be centered over each circumferential joint and secured by tightening of a clip or by use of separate ½" wide stainless steel banding (.015" minimum thickness).

3) Fittings: All elbows, tubes, turns, sweeps and bends shall be insulated with metered sections of insulation and covered with preformed aluminum fitting cover. Joints shall be sealed with a sealing compound and preformed aluminum bands such as Manville Miter-Seals.

f. Insulated piping exposed in mechanical equipment rooms shall be coated using arabol and canvas or white PVC plastic jacket installed in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 GENERAL

A. Insulation shall be applied in a workmanlike manner by experienced, qualified workmen.

B. Insulation shall not be applied until all pressure testing has been completed, inspected and released for insulation applications. (This does not apply to ductwork with acoustical liner.)

C. No pipe insulation shall be cut where a hanger is located. If hangers have been installed which violates this strict requirement notify the Architect immediately.

D. All surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.

E. All adhesives, cements, and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.

F. Install insulation using professional insulators who have adequate experience and ability.

G. Exposed-to-view insulation shall have a well-tailored appearance.

3.02 INSTALLATION OF INSULATION

A. Piping Insulation:

1. Insulation end joints to be tightly butted together and the longitudinal seam stapled closed with outward clinch staples, 3" on center. Before stapling, heavily coat the underside of the jacket overlap with vapor barrier adhesive, Childers CP-30 or equal. Locate all longitudinal seams out of sight. Cover end joints with factory furnished, 4" wide vapor barrier striping tapes, heavily coating the underside and secure with vapor barrier adhesive. Seal all ends of pipe insulation with vapor barrier mastic at valves, fittings, flanges, direct hanger contacts and every butt joint of straight run.

2. In addition to ASJ jacket, cover all piping, valves, fittings, etc., in the mechanical rooms and all catwalk areas and where exposed to view with white PVC plastic jacket installed in accordance with manufacturer's instructions or 8-ounce canvas sized with Foster's 30-36 or equal Arabol lagging adhesive and left suitable for painting. Final installation shall be vaportight.

3. Valves, Fittings and Flanges: Insulate all valves, fittings and flanges with 3-pound density, flexible fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with premolded 25/50 rated PVC fittings, vapor sealed with Childers CP-30 vapor barrier mastic.

4. Hangers and Rollers: At hangers and rollers where the pipe is supported by the insulation, the Insulation Contractor shall install an insert section of wood cellular glass or calcium silicate on all piping 3" diameter and larger inside the vapor barrier. The length of insert section shall not be less than 12" for all piping through 8" and 18" on pipe size 10" and over. Coat the insert section with vapor barrier mastic to provide an effective vapor seal.

   Provide a protective shield covering of 18 gauge for piping 6" and smaller and 16 gauge for 8" and larger, galvanized steel placed centrally between the insert section of all hangers and rollers. Shield shall cover half of the insulation and have a length of not less than 12" on pipe sizes up to 8" and 18" on pipe sizes 10" and over.

END OF SECTION 22 07 00

SECTION 22 11 16

PIPING AND FITTINGS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

B. Provide and install all piping for plumbing systems complete with all necessary pipe, tube, hangers, supports, restraints, isolators, fittings, hardware and pipe cleaning/testing as necessary for fully functional piping systems.

1.02 RELATED WORK

A. Section 22 05 00: Common Work Results for Plumbing.

B. Section 22 05 10: Cleaning Plumbing Systems.

C. Section 22 05 15: Testing Plumbing Systems.

D. Section 22 05 29: Pipe Hangers.

E. Section 22 05 23: Valves.

F. Section 22 07 00: Plumbing Insulation.

G. Section 07 14 00: Fracture Resistant Waterproof Membrane System

1.03 SUBMITTALS

A. Submit seven copies of all piping and fittings for review by the Architect.

B. Submit seven copies of all welders' qualification and test records for review by the Architect.

PART 2 PRODUCTS

2.01 COPPER TUBING

A. Acceptable Manufacturers for Copper Tubing and Fittings: Anderson Metals Corp., Brasscraft, Mueller Brass, Elkhart, Milwaukee, Nibco, Anaconda, Victaulic.

B. Type L, hard drawn, seamless, conforming to ASTM B88, for domestic cold water piping.

C. Type K, rolled, soft drawn seamless, conforming to ASTM B88, for use under slabs and underground where lengths of pipe runs between fittings exceed maximum hard drawn pipe section lengths. Solder joints below grade or slabs are not permitted.

D. Type M, hard drawn seamless, conforming to ASTM B42 for drain piping.

E. Type DWV hard drawn seamless, conforming to ASTM B-306 with drainage fittings for sizes 1-1/4" - 8".

2.02 COPPER TUBING FITTINGS

A. Sweat type, wrought copper, ASTM B16.22, with dimensions conforming to ANSI B16.22 and sweep patterns for copper tubing.

B. Brazing type, wrought copper conforming to MSS SP.73 for copper tubing.

C. Type DWV fittings, cast copper alloy solder joint drainage fittings conforming to ASME B16.23.

D. Dielectric Connections: Epco Sales, Inc., or "V-Line" (as manufactured by Lochinvar Company) dielectric couplers. Use couplers at junction of steel pipe and equipment with copper piping systems. Do not use steel or cast iron fittings in copper piping system. Brass fittings may be used for dielectric locations.

E. Unions: Brass ground joint, 250 lb. working pressure.

F. Nipples: Brass.

G. Mechanical couplings, Victaulic or equal, all copper, designed for grooved copper pipe system.

2.03 CAST IRON SOIL AND VENT PIPE

A. Acceptable Manufacturers: AB&I, Tyler.

B. Below Grade : All waste, vent and sewer lines shall be of cast iron soil pipe and fittings, and shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and manufactured by AB&I Foundry, Charlotte Pipe & Foundry Company or Tyler Pipe, or shall receive prior approval of the engineer.

C. Above Grade: All waste, vent and sewer lines shall be of cast iron soil pipe and fittings, and shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.

D. Joints in Cast Iron Pipe:

1. Acceptable Manufacturers: Husky, Clamp-All, MG, Standard Stainless Steel no-hub couplings, Tyler.

2. Below grade: Joints for hub and spigot pipe and fittings shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or shall be installed with lead and oakum.

3. Above Grade: Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions, CISPI Standard 310 and local code requirements. Hubless coupling gaskets shall conform to ASTM Standard C-564.

E. Latest issue of each standard listed above shall apply.

2.04 MISCELLANEOUS PIPE ACCESSORIES

A. Sleeves: Schedule 10 or 40 steel pipe or 26 gauge galvanized sheet metal, except use 18 gauge galvanized sheet metal for floor penetrations in mechanical rooms. (See Section 22 11 17 for sleeve requirements.)

B. Escutcheons: Chrome pipe escutcheons, slip-on or split type where pipe passing through finished walls may be visible. Escutcheons are not required in mechanical rooms and janitor closets.

C. Exposed Metal Pipe and Trim in Administrative and Public Areas: Chrome plated.

D. Pipe saddles to be 18 gauge sheet metal or galvanized installed to protect insulation as required by appropriate section of this chapter.

2.05 FIREPROOF PENETRATION SEALANTS

A. Acceptable manufacturers: Fyre Putty, 3M Fire Barrier, Flame Seal Fire Barrier.

B. U.L. Listed rated material classified for use in through-penetration Fire Stop System No's. 124, 125, 150, 151.

C. ASTM Listed flame spread/smoke development of 25/50 with ASTM E-84.

2.06 SDWA – SAFE DRINKING WATER ACT

A. General

1. All potable water components installed on this project shall meet or exceed the requirements of the SDWA in all respects. This requirement reduces the permissible levels of lead in the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures to a weighted average of not more than 0.25%. The 0.20% lead limit for solders and flux first implemented in 1986 and stipulates a method for calculating the weighted average lead content is required as well on this project. Products that meet this standard are referred to in the SWDA law as "Lead Free."

2. All products on this project shall be certified by an independent third-party laboratory and certifying that is listed to NSF 61 Standards.

3. Piping, pipe fittings, plumbing fittings and fixtures that are installed on this project that are installed that do not meet or exceed the SDWA will be required to be removed at the Contractor's expense and replaced with an approved SDWA product.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Clean inside of pipe prior to installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.

B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment, or any portion of electrical equipment.

C. Run pipes in straight lines and square with building. Install vertical piping plumb. Make offsets only where indicated and where necessary.

D. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide loops, offsets, and expansion joints as shown on drawings. If, in Contractor's opinion, inadequate loops or offsets are shown, contact Architect for instructions.

E. Provide flanges and unions throughout the pipe systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.

F. Excavation and Backfill:

1. The Contractor shall do all excavations, filling, and backfilling necessary for the installation of his work including shoring, bailing, and pumping as required to maintain his trenches and keep them in dry condition until the piping required has been installed, tested, and
approved. Remove all excess excavated materials and remove from the site. Do not cut any trenches near of under footings without first consulting with the Architect. Compact and tamp backfill to original grade and remove excess dirt as directed. No work shall be covered until properly tested and approved.

   All pavement, sidewalk, piping, and electrical conduit, caused to be cut or damaged by this section shall be restored to original condition by workmen qualified and active in the trades involved.

2. Prepare all trenches for non-metal piping systems as directed by piping manufacturers. In no case shall trench preparation be less than a 4 inch deep bed of pea gravel full width of trench. Surround pipe with 6" cover of pea gravel.

3. Do all backfilling and final grading as directed in the Architectural Specifications and Drawings. Excavation and backfill shall be in accordance with all requirements of Division 02 of the Architectural Specifications.

G. Grading Pipes for Drainage:

1. Uniformly place storm drainage pipes and footing drain pipes at elevations and slopes indicated. If no elevations or slopes are indicated, slope pipes at not less than 1/8" per foot for 4" and larger, 1/4" per foot for 3" pipe and smaller.
2. Uniformly place sanitary sewer pipes at elevations and slopes indicated. If no elevations or slopes are indicated, contact Architect for instructions before proceeding.

3. Provide air vents in each high section of piping. Provide drain valves in low section of piping. Vents and drains are required for chilled water, heating hot water, condenser water, and domestic water systems. Install pipes free of sags, traps, and unnecessary bends. Install drain valves in steam piping.

4. Do not close up, furr in, or cover piping before it has been tested and inspected as specified.

5. Cover or plug openings in pipes, drains, fittings and equipment during construction to keep system free of foreign matter.

6. Conceal all piping unless otherwise indicated or specified.

7. Install piping to maintain headroom, keep access openings clear and offset piping as required to maintain clearances.

8. Do not spring, bend or force pipe into place. Use fittings for all offsets and changes of alignment in piping.

9. Do not use street elbows, bushings and longscrew nipples.

10. Do not install piping above electrical equipment or in or through a room dedicated to electrical equipment.

11. Where change in pipe size occurs, use appropriate reducing fittings, no bushings.

H. Mill wrap all uninsulated underground steel pipe with Republic X-TRU-COAT or equal.

3.02 PIPE JOINTING

A. Preparing Pipe Ends:

1. Cut pipe ends square with pipe cutters only. Do not use hacksaws or torch.

2. Ream pipe ends, after cutting, to full inside diameter.

3. Where pipe is to be threaded, die-cut right hand, clean cut full depth, ream to slight bevel taper threads. Make threaded joints so that they will be leak-proof without caulking after jointing. Leave not more than 3 full threads exposed.

4. Apply a thin coat of approved pipe lubricant to male threads only.

B. Soldered and Brazed Joints:

1. Lines 1/2" - 2": Make copper pipe joints with water soluble flux conforming to ASTM B813 and lead free solder.

2. Lines 2-1/2" or larger: Make type K copper pipe joints with water soluble flux conforming to ASTM B813 and high melt point silver solder or phos-copper solder.

3. Use no lead solders for industrial water, domestic or potable water piping systems.

C. Cast Iron Pipe Joints: Install compression gaskets and no-hub couplings in accordance with manufacturer's instructions.

D. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.

2. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings, and changes of pipe direction.

3.03 PIPE SLEEVES & ESCUTCHEONS

A. Sleeve all pipes passing through masonry or concrete floors and walls. For above ground concrete floors or walls where the opening for the pipe penetration is core-drilled, sleeves may be omitted.

B. Provide piping passing through masonry, concrete, tile and gypsum wall construction with not lighter than 22 gauge galvanized steel sleeves with lock seam, except as otherwise indicated. Sleeves for non-insulated piping passing through gypsum wall construction may be omitted.

C. Sleeves for insulated pipe must be large enough to clear insulation.

D. Where pipe motion due to expansion and contraction will occur, make sleeve of sufficient diameter to permit free movement of the pipes.

3.04 VALVE ACCESS

A. Locate shutoff and control valves for easy access and operation. Where valves are located in enclosed spaces, access doors and installation is under other divisions of these specifications (Division 08). Locate valve at the following locations: Pressure connection to equipment. Branch connections from vertical risers, domestic connections to utilities.

B. Concealment: Unless otherwise indicated, conceal all valves in the finished parts of the building.

C. Grouping: Wherever possible, group valves to provide a neat appearance with all parts accessible.

D. Valves on horizontal piping are to be placed in the upright position only.

3.05 CONTROL SYSTEMS CONNECTORS

A. Weld connectors at points indicated, and at other points where necessary for installation of thermometers and automatic controls.

3.06 RECHECKING AND REPAIRING

A. Before piping is concealed, recheck it for leaks.

B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking, and doping are not permitted.

3.07 CLEANING OF PIPE

A. Before piping is accepted by the Architect, clean and sterilize the piping systems as described in Section 22 05 10. Present test results of sterilization to Architect prior to acceptance of system.

3.08 FIRE STOP MATERIAL

A. Install U.L. assembly at all locations where piping or conduit is stubbed through rated walls and or floors.

3.09 UNIONS, FLANGES AND DIELECTRIC COUPLINGS

A. Unions required: On inlet and outlet of all automatic valves and equipment with connections 2" and smaller.

B. Dielectric Couplings: Provide dielectric couplings at all points where copper or brass pipe or equipment is joined to ferrous pipe and equipment. This requirements does not apply to brass valves in steel lines or joints between copper and cast iron drainage lines.

3.10 PIPE AND VALVE IDENTIFICATION

A. See Section 22 05 00.

END OF SECTION 22 11 16

SECTION 22 11 17

SLEEVES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Comply with the provisions of Section 22 05 00.

B. Provide and install sleeves for piping installed under this Division at floor, rated walls and partitions. Where core-drilled openings are provided for above ground concrete walls or floors, sleeves may be omitted. For rated or non-rated gypsum wall construction, at non-insulated pipe penetrations, sleeves may be omitted. Caulk openings as required per U.L. Requirements and provide escutcheons at all locations exposed to view.

1.02 COORDINATION

A. Coordinate work to insure that sleeves are being provided at rated partitions and floors in accordance with rated fire separation requirements of the architectural drawings.

1.03 RELATED WORK

A. Section 22 11 16: Piping and Fittings.

B. Section 22 13 19: Sanitary Waste Piping Specialties.

1.04 SUBMITTALS

A. Submittals are not required for materials used under this section.

PART 2 PRODUCTS

2.01 SLEEVES

A. Schedule 10 steel or 18 gauge sheet metal.

B. Schedule 40 steel, black or galvanized.

2.02 ESCUTCHEONS PLATES

A. Chrome-plated escutcheon plates as specified below.

PART 3 EXECUTION

3.01 GENERAL

A. Locate sleeves in rated walls and partitions and floors as required by the Architectural Plans.

B. When pipe or conduit is stubbed through rated walls and/or floors, seal penetration with U.L. listed fire-stop material. Refer to the details located on the drawing for additional requirements.

C. Steel sleeves through concrete and precast walls are to have embedded cleats or rings for position retention.

3.02 ESCUTCHEONS PLATES

A. Provide chromium-plated escutcheon plates for uninsulated pipes projecting through floors or walls in "finished" spaces. Mechanical rooms, electric closets, and janitor's closets are not considered "finished spaces.

END OF SECTION 22 11 17

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 22 05 00.

1. Provide and install all plumbing specialties as specified herein and as indicated on the drawings, complete with all necessary hardware and supports necessary for a fully functional installation.

1.02 RELATED WORK

A. Section 22 11 16: Piping and Fittings.

B. Section 22 05 29: Pipe Hangers.

C. Section 22 05 23: Valves.

D. Section 22 07 00: Plumbing Insulation.

1.03 SUBMITTALS

A. Submit seven copies of all plumbing specialties for approval by Architect.

PART 2 PRODUCTS

2.01 BACKFLOW PREVENTERS

A. Provide backflow preventers by Beeco, Febco, Cla-Val, Watts, Wilkens, or Conbraco.

B. Unit shall operate completely automatic and be fitted with tight-closing shutoff valves.

C. All parts must be replaceable and serviceable without removing unit from line.

D. Total pressure drop through complete backflow preventer shall not exceed listed psi loss at rated flow, as shown on drawings.

E. Backflow preventer assembly shall include wye strainer basket upstream of the backflow preventer with blow down valve.

F. Each device installed in doors or if specifically called for shall be equipped with a waste port air gap assembly that is to be piped full size to the nearest approved indirect waste receptor.

2.02 CLEANOUTS

A. Provide cleanouts manufactured by Josam, Zurn, Wade, J. R. Smith, Watts or equal, the following numbers listed are J. R. Smith.

B. Wall: 4422 cast iron caulking ferrule with nikaloy smooth round frame and stainless steel cover, taper threaded bronze plug.

C. Cleanout finished trim is to be taped during all construction phases.

2.03 SDWA – SAFE DRINKING WATER ACT

A. General

1. All potable water components installed on this project shall meet or exceed the requirements of the SDWA in all respects. This requirement reduces the permissible levels of lead in the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures to a weighted average of not more than 0.25%. The 0.20% lead limit for solders and flux first implemented in 1986 and stipulates a method for calculating the weighted average lead content is required as well on this project. Products that meet this standard are referred to in the SWDA law as "Lead Free."

2. All products on this project shall be certified by an independent third-party laboratory and certifying that is listed to NSF 61 Standards.

3. Piping, pipe fittings, plumbing fittings and fixtures that are installed on this project that are installed that do not meet or exceed the SDWA will be required to be removed at the Contractor's expense and replaced with an approved SDWA product.

PART 3 EXECUTION

3.01 BACKFLOW PREVENTERS

A. Pipe relief through fixed air gap fitting and discharge indirect to sewer as indicated on drawings.

B. Install adjacent to wall and/or floor utilizing stand-off brackets, angle frame, and/or concrete piers. Comply with local codes regarding maximum service elevations.

C. Test unit for leaks and pressure drop. Clean and/or replace soiled strainer media.

D. Install in accordance with manufacturer's recommendations.

E. Provide initial test of the backflow device. Test is to be performed by a certified agent and a test certificate is to be forwarded to the Architect.

3.02 CLEANOUTS

A. Locate line size cleanouts, except 4" largest required, at base of all soil and waste stacks, at all changes in direction and in straight runs.

B. Cleanouts shall be installed in an accessible location.

C. Provide two (2) way cleanouts where waste mains exit buildings ahead of sewer connections.

END OF SECTION 22 11 19

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Comply with the provisions of Section 22 05 00.

B. Contractor shall provide and install plumbing fixtures as specified herein and as indicated on the drawings, complete with all trim and related items such as drains, cleanouts, fixture supports and other accessory items necessary for a complete and fully functional fixture installation.

C. Examine architectural drawings to insure fixtures and related items required are provided and installed under this Section. Locate and install items in accordance with Contract Documents and approved manufacturers rough-in drawings.

1.02 RELATED WORK

A. Section 22 13 19: Sanitary Waste Piping Specialties.

B. Section 22 11 16: Piping and Fittings.

C. Section 07 14 00: Fracture Resistant Waterproof Membrane System

1.03 CODES AND STANDARDS

A. All work performed in accordance with IBC, IPC, IMC Codes, Americans with Disabilities Act and standards enforced by local authorities.

1.04 SUBMITTALS

A. Submit seven copies of fixtures and related items for approval of Architect.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Plumbing fixtures and related items shall be a complete unit ready for installation as set forth in these specifications and shown on the drawings.

B. Floor Sinks: Jay R. Smith, Josam, Zurn, Wade.

2.02 PLUMBING FIXTURES (See the drawings for the list of plumbing fixtures.

2.03 FLOOR SINK

A. As scheduled on the Drawings.

2.04 SDWA – SAFE DRINKING WATER ACT

A. General

1. All potable water components installed on this project shall meet or exceed the requirements of the SDWA in all respects. This requirement reduces the permissible levels of lead in the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures to a weighted average of not more than 0.25%. The 0.20% lead limit for solders and flux first implemented in 1986 and stipulates a method for calculating the weighted average lead content is required as well on this project. Products that meet this standard are referred to in the SWDA law as "Lead Free."

2. All products on this project shall be certified by an independent third-party laboratory and certifying that is listed to NSF 61 Standards.

3. Piping, pipe fittings, plumbing fittings and fixtures that are installed on this project that are installed that do not meet or exceed the SDWA will be required to be removed at the Contractor's expense and replaced with an approved SDWA product.

PART 3 EXECUTION

3.01 FIXTURE CONNECTIONS

A. Connect to plumbing fixtures and equipment provided under this and other sections of specifications, architectural drawings, and/or manufacturer's approved shop drawings. Provide rough-in connections where called for.

B. Follow schedule, details on plans, or manufacturer's approved shop drawings for connection sizes to fixtures.

C. Each fixture, floor drain, and piece of equipment to have separate trap(s) installed as close to fixtures possible.

3.02 TESTING AND CLEANING

A. Inspect and test work to insure installation is in accordance with plans and specifications and is functioning as designed. Test procedures and pressure as specified in Section 22 05 15.

B. Correct all deficiencies found and retest.

C. Turn work over to Owner in a clean, sanitary condition.

END OF SECTION 22 40 00

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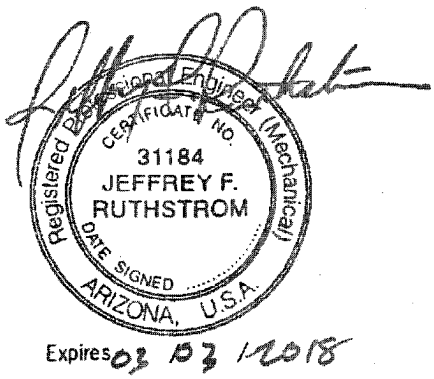

Expires 03 / 07 / 2018

SECTION 23 05 00

GENERAL HVAC REQUIREMENTS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Labor, materials, tools, and services for a complete and operable installation of equipment and systems as applies to all sections included in Division 23 and Contract Documents.

B. Principal features of the work included are:

1. Heating, ventilating, air conditioning systems, piping, and controls.
2. Ground mounted steel frames for HVAC system, cooling towers, separators, and pumps furnished and set under this Division.
3. Patching of walls and floors cut to fit HVAC system components.
4. Furnish anchor bolts, sleeves, supports and similar items to be built into concrete and masonry.
5. Preparation for testing and balance of mechanical systems and correcting deficiencies.
6. Preparation and submittal of shop drawings, product data, and samples.
7. Maintaining a record set of blueline prints and marking them to indicate locations of concealed items, and deviations made to suit conditions and production of mechanical as-built (record) drawings.
8. Attendance of a pre-construction conference to occur within 15 days after award of contract. Major Division 23 Sub-Contractor required attendance shall be Mechanical's Representative and Superintendent for this project.

1.02 RELATED WORK

A. Division 01: Maintenance and operations manuals.

B. Division 03: Concrete (equipment pads, as may be required for items in Division 23 that are not provided for by General Contractor).

C. Division 06: Rough Carpentry (wood blocking in walls required for attaching plumbing/mechanical items).

D. Division 07: Flashing and Sheet Metal (flashing for plumbing/mechanical items penetrating walls and roof).

E. Division 09: Painting.

F. Division 26: Electrical.

1.03 JOB CONDITIONS

A. Submittal of bid implies bidder has read applicable paragraphs of the specifications including the AIA General Conditions Document A201 and will be bound by their conditions.

B. The Mechanical Contractor shall have a minimum of five years experience installing commercial cooling and heating systems similar to those described in these specifications and provide a list to the City of Glendale Project Manager and Engineer of five previous projects including name of project and contact person names and phone numbers as a separate document in addition to the mechanical bid or proposal submitted by the General Contractor.

C. The Mechanical Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Arizona as a Mechanical Contractor.

D. The Mechanical Contractor shall be able to bond work he is bidding to perform and shall provide a written statement to the Engineer from the bonding agency proposed to be used for this project as a separate document in addition to the mechanical bid or proposal submitted by the General Contractor. The bonding agency proposed to be used by the Mechanical Contractor shall have a Best's insurance rating of A or A+.

1.04 LOCAL CONDITIONS

A. Conform to local site conditions, as required/necessary:

1. Project Site Design Conditions

Temperature - Outdoors:	Summer 115 deg F maximum Winter 25 deg F minimum
Temperature - Indoors:	Summer 75 deg F maximum Winter 70 deg F minimum

B. Coordinate with, and prior to submitting of bid, this Contractor shall verify all utility (gas, sewer and water) connections with the local utility company(ies) serving this project. Pay special attention to, but not necessarily limited to: invert elevations, size, pressure, other utilities in the area, etc... Include in bid price all costs for permits, bonds, tap fees, manholes, meter and/or backflow installations, etc...

C. Existing conditions and/or Facility/Utility: This Contractor shall coordinate in writing Seven (7) business days prior to start of work for any shut-down and/or removal of any existing condition(s). Coordination letter shall identify start/stop times (shut down time), and total manhours to perform all facets of necessary work. This coordination letter shall be submitted to the Engineer.

1.05 EXAMINATION OF PREMISES

A. Visit the site before submitting a Bid or Proposal, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.06 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01.

B. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Engineer with certificates of inspections and approvals by the local authorities in accordance with Division 01.

1.07 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and all required offsets, bends, special fittings and exact locations are not indicated.

Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear. Notify Engineer of any special building conditions and special building areas in which the drawings conflict as to the fit of ductwork, piping or equipment. This notification shall occur in written form (such as an 'RFI'), prior to the installation of any work in these special areas.

This notice shall occur prior to the purchase and/or shipment of equipment to the job site for these areas. The Engineer shall effect an alternate relocation of the ceiling, duct, or piping to avoid installing materials more than one time.

1.08 INTENT

A. The contract documents (drawings, plans and specifications) describe the mechanical work of this project. Any item mentioned in one part shall be as binding as though mentioned in all parts.

B. The contract documents form a guide for a complete and operable mechanical installation. Where an item is reasonably necessary but not specifically mentioned, such as duct hangers or transitions, piping offsets, drains, vents, etc., for a complete system, provide same as if were specified.

C. Mechanical system layouts indicated on drawings are diagrammatical only. Exact locations of ducts, pipes, and equipment shall be coordinated with related trades prior to installation of any work. Also these locations shall be coordinated with the Engineer for evaluation regarding future building needs. This relocation/rerouting review (if required) shall occur prior to actual work bring.

D. The Engineer shall not be responsible for the means, methods, procedures, techniques, or sequences of construction, nor for safety on the job site, nor shall the Engineer be responsible for the contractor's failure to carry out the work in accordance with the contract documents.

E. Compliance by the Contractor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically suited to meet operating guarantees at the specified service conditions.

1.09 DEVIATIONS

A. Deviations from specifications and drawings shall not be made without full knowledge and written consent of the Engineer.

B. Contractor shall report all items discovered during construction that require deviation from the Contract Documents. See Division 01 for procedures.

1.10 QUALITY ASSURANCE

A. Comply with applicable local, state and federal codes.

B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades. (See individual Section of Division 23.)

C. Employ only qualified journeymen for this work. Employ competent, qualified mechanics to supervise the work.

1.11 CODES AND STANDARDS

A. Perform work specified in Division 23 in accordance with codes and standards listed below, and such standards that may be specified in other sections. When these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the Engineer.

1. NFPA 90A: Air Conditioning and Ventilation Systems.
2. NFPA 101: Life Safety Code.
3. 2012 International Building Code.
4. 2012 International Mechanical Code.
5. 2012 International Plumbing Code.
6. ANSI Handicapped Code-A117.1.
7. ANSI: American National Standards Institute.
8. ARI: American Refrigeration Institute.
9. ASHRAE: American Society of Heating Refrigeration and Air Conditioning.
10. ASME: American Society for Mechanical Engineers.
11. ASTM: American Society for Testing and Materials.
12. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.

13. NEMA: National Electrical Manufacturers' Association.

14. NFPA: National Fire Protection Association.

15. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

16. UL: Underwriters' Laboratories, Inc.

17. ADA: Americans with Disabilities Act.

1.12 COORDINATION

A. Carefully examine specifications and drawings to be thoroughly familiar with items which require HVAC connections and coordination.

B. Coordinate with other Divisions to leave proper chases and openings. Place outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

1.13 SUBMITTALS

A. In the case of substitution the Contractor shall include clearly marked engineering data on both the specified items and the proposed substitute items. In some cases, as deemed proper by the Engineer and/or Engineer, Table Top Inspections of both the specified item and the proposed substitute item may be required for the purpose of direct comparison. The Contractor shall deliver each of the two items in fully functioning condition at the contractor's expense to a location as directed by the Engineer and/or Engineer.

B. Submit items to the Engineer. Submittals are only required for specific items of equipment or material listed in individual sections of these specifications.

C. Within 15 days after award of contract for this work, submit a complete list of proposed manufacturers from all individual sections of the Division 23 Specification (of equipment or material to be used) for approval by the Engineer/Engineer.

Submit this list before submittal of shop drawings and product data, and obtain approval before submitting items listed below. If Engineer/Engineer does not approve a proposed manufacturer, then coordinate with him in selecting another manufacturer who does meet with his approval.

D. Shop Drawings: Within 30 days after award of Contract for this work. Submit one reproducible of shop drawings of ductwork, piping, and equipment and seven copies of product brochures as required from all individual sections of the Division 23 specification at one time in a 3-ring binder; one complete binder for all HVAC items indexed and separated by dividers. Partial submittals will not be accepted.

E. Brochures: Submit seven copies of manufacturer's brochures including:

1. Complete descriptions.

2. Illustrations.

3. Specifications data of materials, and operating rates, fan curves, weights, electrical characteristics, etc.

4. Where items other than those proposed for use are illustrated and/or described on the same brochure pages, clearly indicate the items proposed for use.

F. Samples: Generally, samples will not be required, but if there is doubt on the part of the Engineer/Engineer as to unit prepared for use, he may call for a sample. In that case, pay for packaging and transportation both ways. Item will remain the property of the submitter and may, if approved, be incorporated in the work.

G. Any piece of equipment placed on the job without prior written review shall be subject to removal.

1.14 OPERATING AND MAINTENANCE MANUALS

A. Three sets of the following data are required:

1. Operating and maintenance instructions prepared in accordance with Division 01 of these specifications.

2. Spare parts lists.

3. Illustrated parts breakdown for each piece of equipment.

4. Copies of approved submittal data.

5. Local supply house name and address, local supply house phone number and contact person for each item of equipment for future parts procurement. Also include National and/or Regional Headquarters phone number.

6. Equipment warranties.

7. Air and water balance report.

8. Control wiring diagrams, operating sequences, and devices literature.

9. All programmable logic documentation.

10. All as-built drawings.

11. Valve tag identification chart.

B. Arrange each set of data in an orderly way, and bind each set in a separate three-ring, hard cover binder.

C. Two weeks prior to substantial completion of the project deliver three complete sets to Engineer to be used for the Owners training of equipment operating personnel.

1.15 DELIVERY AND STORAGE

A. Deliver items in manufacturer's original unopened packaging. Cover items with protective materials to keep them from being damaged (physical and weather).

B. Store items in a clean, dry place, and protect from damage which may be caused by theft, the weather, and/or all building and construction operations.

C. All flange facings shall be protected by securely fastened durable covers to prevent damage during shipment.

D. Exposed finished and machined surfaces, including bolting, shall be given a heavy coating of rust-inhibiting compound. Internal metal surfaces shall be sprayed or coated with a suitable rust preventative which is strippable.

E. Bearings, bearing housings, and oil systems, including reservoirs, coolers, filters, and piping, shall be thoroughly cleaned internally of metal particles, dirt and debris, and coated with a suitable rust preventative prior to shipment.

F. All instruments and valves, including auxiliary systems, must be securely mounted and/or supported to eliminate damage during shipment, storage, operation, and maintenance.

G. Supports and rigging connections shall be provided to prevent damage during transit, lifting or unloading.

H. Threaded connections shall be provided with a pipe plug of the same material as the connections (except cast iron connections shall have steel plugs). Plugs shall have a square or hex head. Teflon tape shall be used as a thread sealant.

I. Open ends of tubes and pipe shall be capped (just taping is not adequate) for protection.

1.16 GUARANTEE

A. Guarantee all material, equipment, and workmanship for all sections under Division 23 in writing to be free from defects of material and workmanship for a minimum of one (1) year from date of final acceptance by the Owner or substantial completion. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Acceptable Manufacturers: In general see individual sections of these specifications.

B. Within the Contract Documents relating to mechanical work, manufacturers' names, catalog numbers, and other proprietary references to materials and equipment are made. Such references are made to establish the standards of quality and type required, and not to limit competition. Most known or acceptable manufacturers of competitive products are listed in applicable sections as "Acceptable Manufacturers". Reasonable requests for substitution or additions to "Acceptable Manufactures" will be considered, but the Engineer will be the sole judge of acceptability of items proposed as substitutes.

C. Materials and equipment used in carrying out these specifications shall bear UL or other codes and standards, listed in Section 1.12, recognized testing laboratory label.

D. Where substitutions are desired, comply with the requirements of Division 01, Substitutions and Product Options.

2.02 PIPE AND VALVE MARKERS

A. This Contractor shall prepare a chart or diagram for each piping system, indicate by number each valve in the system and each valve's location, function, and whether normally open or normally closed. Numbers used on valves shall correspond with chart.

B. Acceptable Manufacturers: Seton, Westline, Brady.

C. Pipe markers: Seton Model, "Setmark" Series pipe markers with directional flow arrows (where required), and the applicable ANSI/OSHA pipe name and color scheme.

D. Valve Markers: Brass, aluminum or plastic disc not less than 1-1/4" diameter and bearing engraved numbers corresponding to those shown on chart and fasten to valve with No. 16 zinc plated steel jack chain. Lettering shall be a minimum 1/2" in height.

2.03 SUPPORTS, ANCHORAGE AND RESTRAINTS

A. General

1. When supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping and ductwork are not shown on the Drawings, the Contractor shall be responsible for their design.

2. Seismic restraints and anchorages shall resist seismic forces, as specified in latest edition of the International Building Code, for the seismic zone specified above.

3. Seismic restraints shall not introduce stresses in piping or ductwork caused by thermal expansion or contraction.

4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Suspended Piping and Ductwork: Seismic restraints shall be in accordance with the latest edition of the SMACNA "Seismic Restraint Manual - Guidelines for Mechanical Systems" for the Seismic Hazard Level (SHL) as specified above.

C. Submittal Requirements:

1. Suspended piping and ductwork: Submit shop drawings of piping and ductwork indicating point loads and seismic restraint locations, along with applicable details keyed to layouts.

2. Support frames, equipment supports, and anchorage: Submit shop drawings indicating point loads and seismic restraint locations, along with Engineer's calculations and details keyed to the layouts pertaining to support frames, anchorages, and seismic restraints.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment installations shall be in accordance with the requirements and recommendations of the equipment manufacturer.

3.02 LOCATIONS

A. Mechanical layouts indicated on drawings are diagrammatical. Exact locations of ducts, pipes, and equipment may vary because of conflicts with work of other trades. Work out conflicts where relocations will not affect operation or appearance of systems prior to installing any equipment, ductwork, or piping. Also, these locations shall be coordinated with the Engineer/Engineer for evaluation regarding future building needs.

B. Locate equipment requiring periodic servicing so that it is "readily accessible". Do not back up service sides to walls, nor place it too close to other equipment making service impractical. Coordinate with manufacturers' recommended equipment placement guidelines to determine maintenance access required.

C. All equipment and appurtenances shall be installed in accordance with the requirements of the manufacturer.

3.03 CUTTING AND PATCHING

A. Cut and patch per Division 01 as necessary to properly install the work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Engineer.

B. Repair or replace routine damage caused by cutting in performance of contract.

C. Correct unnecessary damage caused due to installation of mechanical work.

D. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.04 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.05 COUNTER FLASHING

A. Counter-flash ducts, pipes, etc., at penetrations of roofs and outside walls. Coordinate with Engineer and/or General Contractor for roof type, and the requirements of same for weather-tight penetrations.

B. Equipment curb heights are to be coordinated with the type of roof structure to be applied. Curbs are to be 6" minimum above any built-up roof finished surface.

3.06 CONNECTION TO EQUIPMENT

A. Connect or install equipment shown on mechanical drawings that requires plumbing and/or mechanical hookups.

B. Rough-in piping and connect equipment.

C. Provide piping, shutoff valves, drain valves and unions as required for a complete and serviceable operable installation.

D. Provide flexible connections to all rotating or vibrating equipment unless otherwise noted or detailed.

3.07 SERVICE OF SYSTEMS

A. If equipment is placed in service prior to acceptance of the project by Owner, operate equipment strictly in accordance with manufacturer's instructions.

1. Employ competent, qualified personnel in operation of the equipment.

2. Provide for proper operation and cleanliness. Provide temporary filters in all air handling equipment.

3. Open up equipment for inspection as directed by the Engineer. Provide a clean set of filters installed after final acceptance of the building by the Engineer.

B. Lubricate equipment and perform such other maintenance as required to place it in optimum operating condition.

3.08 PIPE, VALVE AND CONTROLS MARKING

A. Pipes:

1. In equipment rooms and above accessible ceilings, install bands adjacent to each tee and at 10-foot intervals on straight runs.

2. In furred spaces place bands adjacent to each valve, at each tee, and 12 inches above and below floor at risers.

3. Where exposed in rooms other than equipment rooms, place bands at points of entrance and exit into room, adjacent to each valve visible in the room and at 20 Foot intervals.

4. Identify pipe with verbiage, directional arrows and the following "ANSI/OSHA" colors:

SERVICE	COLOR BACKGROUND	LETTERS
Condensing Water Supply	Green	White
Condensing Water Return	Green	White
Domestic Cold Water	Green	White
Non Potable Cold Water	Green	White

5. Mount one of each chart in every equipment room. Mount each chart in aluminum frame with clear glass front and secure to wall where directed by Engineer or Owner's Representative.

6. Bind copies of each chart in "Operations & Maintenance Manual".

B. Instrument and Controls

1. Identify all panel-mounted instruments and controls with engraved bakelite nameplate permanently affixed to panelboard.

2. Identify all damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape, affixed to controller indicating service and, where applicable, normal setting.

C. Valves

1. Provide each valve with unique number associated to valve chart (as described in Section 2.03 of this specification section).

3.09 ACCEPTANCE OF SYSTEMS

A. Complete the following before requesting a final inspection:

1. Work required under this division of specifications except as permitted. Special attention shall be paid to completion of work required under Section 23 05 10.

2. System balancing.

3. Control system checkout.

4. Furnish required operating instructions, wiring diagrams, and electric "project record document" control diagrams in accordance with Division 01 within a frame with glass face and mount one copy of each in the equipment rooms and as specified elsewhere.

5. Engineer will accept job on basis of tests and inspections. A representative of the firm that performed test and balance work is to be in attendance to assist, and Contractor is to furnish necessary mechanics to operate system, make any necessary adjustments, and assist with final inspection.

6. The Contractor shall be responsible for proper operation of all systems, minor subsystems, and services provided under this Section. He shall coordinate startup procedures, calibration, and system checkout with all subcontractors involved. Any system operational problems shall be diagnosed; all correctional procedures shall be initiated with the various subcontractors as required to bring the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally. Any remaining difficulties shall be brought to the attention of the Engineer.

7. Thoroughly clean all parts of the installation at the completion of the work. The Contractor shall clean up and remove from the premises all refuse material, crates and rubbish arising from his Work. Belt-drive tensions and alignments shall be checked. All motors and bearings shall be lubricated in accordance with the manufacturer's service manuals prior to equipment startup. Provide a lubrication schedule for every item of equipment furnished under this Section. The schedule shall include the type of lubricant and the application frequency.

3.10 TRAINING

A. At a time agreed upon by the Engineer, and Owner's representative provide training of the HVAC system operating personnel. This training shall be for a minimum period of Eight (8) hours exclusive of travel time to the job site. The training shall be by a factory authorized and trained agent of the controls manufacturer. The training shall include, as a minimum, start-up and normal operation for the new Cooling Towers and Filter Separator Systems.

Establishment of Owner/manufacturer interface (name, telephone number, and times of availability of contact person) for future problem resolution, annual maintenance/system checkout shall be established at this time. Training shall include 4 Hours of follow-up sessions to occur at 6 months after project is awarded substantial completion.

END OF SECTION 23 05 00

SECTION 23 05 10

CLEANING MECHANICAL SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Comply with provisions of Section 23 05 00.

B. Cleaning HVAC systems equipment and piping.

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements

B. Section 23 05 28: Piping and Fittings

1.03 SUBMITTAL

A. None Required.

PART 2 PRODUCTS

2.01 NOT APPLICABLE

PART 3 EXECUTION

3.01 DUCTS AND APPARATUS

A. Thoroughly clean Cooling Tower casings before Cooling Tower is filled with water and fans are operated.

3.02 HVAC SYSTEMS AND PIPING

A. Verify cooling tower interior water passages are free of debris prior to starting equipment.

B. Clean condenser water circulating water piping to remove all oils and metal chips. Drain and flush piping system. Clean debris from Y-strainers. When systems are verified as thoroughly flushed and fresh water is added.

3.03 FACTORY FINISHES

A. Clean items with factory finishes.

B. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula.

C. If finishes are damaged to any extent, including but not limited to scratches and unfinished spots, refinish the entire item. Engineer will be the judge of whether refinishing is required.

3.04 GENERAL CLEANUP

A. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Engineer.

B. Stainage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.

END OF SECTION 23 05 10

SECTION 23 05 13

ELECTRIC MOTORS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Comply with the provisions of Section 23 05 00.

B. Provide and install electric motors furnished with equipment as specified herein as recommended by the equipment manufacturer and as indicated on the drawings.

C. Coordinate exact voltage of motors at the jobsite prior to purchasing motors. Coordinate exact voltage of motors provided under Electrical Division of these Specifications prior to installing motors onto equipment provided under Division 23 of these Specifications.

1.02 RELATED WORK

A. Division 26: Electrical Specifications.

1. Motor starters which are not an integral part of motors or are not furnished by manufacturers of Division 23 equipment shall be furnished under Division 26 of these specifications.

2. Electrical connections shall be made in accordance with the Electrical Drawings and Division 26 requirements of these specifications.

1.03 SUBMITTALS

A. Submit seven copies of all motors for review by the Engineer.

PART 2 PRODUCTS

2.01 MOTORS

A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating.

B. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather-protected.

C. High efficiency electric motors shall be installed on pumps and cooling towers.

D. High efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B.

The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

MOTOR HP	FULL LOAD RPM	GUARANTEED MINIMUM FULL LOAD EFF.
3	3600	82.5
7.5	1800	88.5
7.5	3600	88.5
10	1200	90.2
30	3600	91%

E. Motor sound power levels shall not be greater than recommended in NEMA M61-12.49.

F. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.

G. Motor Characteristics:

1. 120/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 ☐C continuous rise.

2. 460/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40°C continuous rise, with ball bearings rated for L-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.

H. Motors located outside of buildings and subject to weather exposure shall be of the "totally enclosed, fan cooled type" (TEFC) and shall be listed for environment exposure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Arrange and set motors.

B. Line up motors on direct drive equipment using dial type gauges.

C. After electrical connections are made, test motor for proper rotation/phasing under Division 26.

D. Multiple belt pulley/drive alignments shall be such that equal tension is present at each belt.

E. Install motors in accordance with the motor manufacturers' written recommendations including providing initial grease or oil as recommended.

3.02 ADJUSTMENTS

A. Adjust motors together with driven equipment to insure equipment is dynamically and statically balanced. Correct any excessive vibration or noise from the equipment.

END OF SECTION 23 05 13

SECTION 23 05 15

TESTING MECHANICAL SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 23 05 00.

B. Test mechanical systems and equipment to demonstrate proper operation.

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements.

B. Section 23 05 10: Cleaning Mechanical Systems.

C. Section 23 05 28: Piping and Fittings.

D. Section 23 05 93: Air Distribution and Water System Test and Balance

1.03 SUBMITTALS

A. Submit Air and Water Balance Agency data in accordance with Section 23 05 93.

1.04 QUALITY ASSURANCE

A. Employ a reputable, AABC or NEBB certified air balance contractor regularly engaged in the work to test and balance HVAC systems in accordance with Section 23 05 93.

1.05 COORDINATION

A. Advise Engineer of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. All instruments used by the Air and Water Balance Contractor shall be accurately calibrated within the past calendar year and maintained in good working order.

B. All instruments used for testing purposes shall be provided and operated in that the design system parameters fall within the mid range of the testing apparatus, and the range shall be such that pressure differential can be read in minimum 1% increments of the actual test pressure.

PART 3 EXECUTION

3.01 TESTING - GENERAL

A. Test systems and equipment installed to demonstrate proper operation.

B. Submit notices of readiness for testing to City of Glendale Project Manager and Engineer and other appropriate people.

C. Correct and retest work found defective when tested.

D. Make repairs to piping systems with new materials. Peening, doping or caulking of joints or holes will not be acceptable.

3.02 AIR SYSTEMS, AIR DISTRIBUTION AND WATER SYSTEM TEST AND BALANCE

A. Perform water systems test and balance in accordance with Section 23 05 93.

3.03 CONDENSATE DRAIN PIPING

A. Test plug opening to permit system to be filled with water to drain pan level. System shall hold water for four hours with no drop in water level.

3.04 CONDENSER WATER PIPING

A. Test piping system upon completion of connection to cooling tower, pumps, and existing piping system. Piping shall withstand a hydrostatic test pressure of 125 PSIG for a period of four hours with no leaks.

B. Verify operation of tower water treatment piping, meter, solenoid valves, and pumps.

3.05 RECORDS OF TESTING

A. Maintain records of all system testing and results thereof.

B. Deliver records of system testing to Engineer as part of the maintenance and operation manual.

END OF SECTION 23 05 15

SECTION 23 05 28

PIPING AND FITTINGS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 23 05 00.

B. Provide and install all piping for mechanical systems complete with all necessary pipe, tube, hangers, supports, restraints, isolators, fittings, hardware and pipe cleaning/testing as necessary for fully functional piping systems.

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements.

B. Section 23 05 10: Cleaning Mechanical Systems.

C. Section 23 05 15: Testing Mechanical Systems.

D. Section 23 05 29: Pipe Hangers.

E. Section 23 05 32: Valves.

F. Section 23 21 23: Circulating Pumps.

G. Section 23 07 00: HVAC System Insulation.

H. Section 07 54 19.01: Thermoplastic Membrane Roofing

I. Section 07 14 00: Fracture Resistant Waterproof Membrane System

1.03 SUBMITTALS

A. Submit seven copies of all piping and fittings for review by the Engineer.

B. Submit seven copies of all welders' qualification and test records for review by the Engineer.

PART 2 PRODUCTS

2.01 STEEL PIPE

A. Acceptable Manufacturers for Steel Pipe and Fittings: Bethlehem, Le Barge Pipe Bending & Coiling, Ohio Pipe, Grinnell, U.S. Steel, Tube Turn, Victaulic, Fee & Mason, Gustin-Bacon, Allied, Daniel, Ladish, Naylor, Anvil, Cajon, American Tube Co, Gruvlok.

B. Butt welded, electric resistance welded, or seamless black steel pipe, ANSI 836.10, ASTM A120, Grade B or A, or ASTM A53, A106, or A134 Schedule 40, for piping 10" and smaller; 0.375" wall thickness for piping 12" through 24" diameter, for:

1. Condenser water piping.

2.02 STRAINERS

A. Acceptable Manufacturers: Armstrong, Sarco, Bush, Illinois, Strong, TACO, Meuller.

2.03 FLEXIBLE PIPE CONNECTORS

A. Acceptable Manufacturers: Mason, Mercer, Metraflex, Proco.

2.04 PRESSURE GAUGES

A. Acceptable Manufacturers: Marsh, Trerice, Weksler, Palmer, Weiss, Miljoco.

2.05 THERMOMETERS

A. Acceptable Manufacturers: Taylor, Weksler, Trerice, Palmer, Johnson, Honeywell, Weiss, Powers, Miljoco.

2.06 STEEL PIPE FITTINGS

A. Flanges, Fittings, Unions and Similar Items: Commercially available products marked in accordance with MSS-SP-25 marking on small size of odd shaped products may be omitted provided they are listed in the sequence so allowed by MSS-SP-25, but such products shall bear the manufacturer's name and trademark. Piping used for condenser water supply/return, watersource heat pump water supply/return.

B. Fittings 2-1/2" and Larger: Carbon steel, butt welded fittings, ASTM A234-QBP, ANSI B16.9, and B16.28. Slip-on flanges are not permitted.

C. Branch Connections from Mains or Headers 2-1/2" or Larger: Welded tees or welding outlets, Bonney Forge Weld-O-Lets or Thread-O-Lets, or equal. Use forged outlets only if branch line is at least one pipe size smaller than main or header. Forged outlets are not allowed for use on fuel gas piping.

D. Fittings 2" and Smaller: Threaded, standard cast iron.

E. Galvanized Steel Pipe Fittings: Same as above, except galvanized coated. Provide drainage pattern type fittings for waste, vent, and drain piping.

F. Flanges: Carbon steel, ASTM A105 and ANSI B16.5 raised face weld neck or slip on raised face.

G. Unions: Cast iron with bronze to iron ground joint rated at 150 lbs, 300 PSI on fuel gas piping.

H. Bolting Materials: Same finished carbon steel bolts and hex nuts, ASTM A307, 55T. Threads and dimensions, ANSI B1.1 and B18.2

I. Thread Lubricant: Crane "Formula 425", or equal. (NOTE: Approved Teflon tape may be used except on natural gas piping.)

J. Gaskets: 1/8" thick Cranite, Sepco, or equal.

K. Mechanical Joints: Victaulic, cut or rolled groove, or equal mechanical joints may be used on steel piping for condenser water piping, or watersource heat pump piping.

L. Strainers: Strainers shall be wye self-cleaning flush type, gray cast iron, with bronze monel metal or stainless steel sediment strainer and 3/4" gate blow-off valve, piped to floor sink or drain. Strainers shall be separate from other components. Integral strainers and traps will not be approved. Strainers 3" and smaller shall have 1/32" perforations and strainers 4" and larger shall have 1/8" perforations and have a minimum open area of 3 times the area of strainer inlet pipe. Use 40 mesh screens and Everdur wool packing during initial cleaning of system.

M. Flexible Connections:

1. Provide Mason MFTNC double sphere type with molded-in steel reinforcing, EPDM construction with ductile iron floating flanges, or approved equal, with minimum ratings of 150 psi and 200 ☐F. Support pip
not allow it to rest on or compress the units. The manufacturer's name shall be affixed to each unit and the service range is to be stated on each tag. Use for:

   a. Condenser water.

   b. Watersource heat pump water.

N. Pressure Gauges:

1. Furnish and install Marsh "Master," Trerice 500X, Weksler "Regal" pressure gauges or approved equal where indicated. The gauges shall have 4-1/2" dial size. The case shall be plain or screwed ring depending on whether the gauge is to be mounted on a panel or to be pipe supported. Cases shall be cast aluminum. The scale range shall be 0 to 150 psi for all water, monel rotary type, nylon gear movement.

2. When gauges are apt to be subjected to a vacuum, provide compound gauges reading 30" to 150 psi.

3. Provide a needle valve at each gauge connection. Valves shall be Trerice 735-2, Whitey B-1VF4 or approved.

4. Gages subjected to pulsations shall be equipped with snubbers.

O. Pipeline Temperature Indication:

1. Thermometers: All pipeline thermometers shall be Trerice Series BX-9, or A405 or approved equal, one-piece case industrial thermometer with glass front, baked black enamel case, brass with 3-4F2 or 138-0015.2 separable socket, red reading thermometer tube, swivel nut on stem (allows installing without rotating thermometer).

   a. All thermometers are to have 9" scale and 1°F scale division. Submit temperature ranges for approval.

b. All thermometer wells are to be extension stem type to clear insulation.

c. Three-quarter inch Thread-O-Lets shall be welded to pipe, or pipe size to 3/4" threaded tee furnished for mounting of well. Direct welding of wells in pipelines will not be permitted.

d. Pipeline Temperature and Pressure Indicators: Furnish and install Peterson Co. "Pete's Plugs" or Sisco pressure-temperature plugs as shown on drawings (yellow dot for heating systems). Provide the Owner with two sets of pressure/temperature probes for his use.

2.07 COPPER TUBING FITTINGS

A. Sweat type, wrought copper, ASTM B16.22, with dimensions conforming to ANSI B16.22 and sweep patterns for copper tubing.

B. Brazing type, wrought copper conforming to MSS SP.73 for copper tubing.

C. Type DWV fittings, cast copper alloy solder joint drainage fittings conforming to ASME B16.23. Use copper tubing for condensate drains and equipment drains serving watersource heat pumps and fluid coolers.

D. Dielectric Connections: Epco Sales, Inc., or "V-Line" (as manufactured by Lochinvar Company) dielectric couplers. Use couplers at junction of steel pipe and equipment with copper piping systems. Do not use steel or cast iron fittings in copper piping system. Brass fittings may be used for dielectric locations.

E. Unions: Brass ground joint, 250 lb. working pressure.

F. Nipples: Brass.

G. Mechanical couplings, Victaulic or equal, all copper, designed for grooved copper pipe system.

2.08 MISCELLANEOUS PIPE ACCESSORIES

A. Sleeves: Schedule 10 or 40 steel pipe or 26 gauge galvanized sheet metal, except use 18 gauge galvanized sheet metal for floor penetrations in mechanical rooms.

B. Escutcheons: Chrome pipe escutcheons, slip-on or split type where pipe passing through finished walls may be visible. Escutcheons are not required in mechanical rooms and janitor closets.

C. Exposed Metal Pipe and Trim in Administrative and Public Areas: Chrome plated.

D. Pipe saddles to be 18 gauge sheet metal or galvanized installed to protect insulation as required by appropriate section of this chapter.

2.09 FIREPROOF PENETRATION SEALANTS

A. Acceptable manufacturers: Fyre Putty, 3M Fire Barrier, Flame Seal Fire Barrier.

B. U.L. Listed rated material classified for use in through-penetration Fire Stop System No's. 124, 125, 150, 151.

C. ASTM Listed flame spread/smoke development of 25/50 with ASTM E-84.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Clean inside of pipe prior to installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.

B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment, or any portion of electrical equipment.

C. Run pipes in straight lines and square with building. Install vertical piping plumb. Make offsets only where indicated and where necessary.

D. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide loops, offsets, and expansion joints as shown on drawings. If, in Contractor's opinion, inadequate loops or offsets are shown, contact Engineer for instructions.

E. Provide flanges and unions throughout the pipe systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.

F. Excavation and Backfill:

1. The Contractor shall do all excavations, filling, and backfilling necessary for the installation of his work including shoring, bailing, and pumping as required to maintain his trenches and keep them in dry condition until the piping required has been installed, tested, and approved. Remove all excess excavated materials and remove from the site. Do not cut any trenches near of under footings without first consulting with the Engineer. Compact and tamp backfill to original grade and remove excess dirt as directed. No work shall be covered until properly tested and approved.

   All pavement, sidewalk, piping, and electrical conduit, caused to be cut or damaged by this section shall be restored to original condition by workmen qualified and active in the trades involved.

2. Prepare all trenches for non-metal piping systems as directed by piping manufacturers. In no case shall trench preparation be less than a 4 inch deep bed of pea gravel full width of trench. Surround pipe with 6" cover of pea gravel.

3. Do all backfilling and final grading as directed in the Engineerural Specifications and Drawings. Excavation and backfill shall be in accordance with all requirements of Division 02 of the Engineerural Specifications.

G. Grading Pipes for Drainage:

1. Provide air vents in each high section of piping. Provide drain valves in low section of piping. Vents and drains are required for condenser water, and watersource heat pump water systems. Install pipes free of sags, traps, and unnecessary bends. Install drain valves in steam piping.

2. Do not close up, furr in, or cover piping before it has been tested and inspected as specified.

3. Cover or plug openings in pipes, drains, fittings and equipment during construction to keep system free of foreign matter.

4. Conceal all piping unless otherwise indicated or specified.

5. Install piping to maintain headroom, keep access openings clear and offset piping as required to maintain clearances.

6. Do not spring, bend or force pipe into place. Use fittings for all offsets and changes of alignment in piping.

7. Do not use street elbows, bushings and longscrew nipples.

8. Do not install piping above electrical equipment or in or through a room dedicated to electrical equipment.

9. Where change in pipe size occurs, use appropriate reducing fittings, no bushings.

H. Mill wrap all uninsulated underground steel pipe with Republic X-TRU-COAT or equal.

3.02 PIPE JOINTING

A. Preparing Pipe Ends:

1. Cut pipe ends square with pipe cutters only. Do not use hacksaws or torch.

2. Ream pipe ends, after cutting, to full inside diameter.

3. Where pipe is to be threaded, die-cut right hand, clean cut full depth, ream to slight bevel taper threads. Make threaded joints so that they will be leak-proof without caulking after jointing. Leave not more than 3 full threads exposed.

4. Apply a thin coat of approved pipe lubricant to male threads only.

B. Soldered and Brazed Joints:

1. Lines 1/2" - 2": Make copper pipe joints with water soluble flux conforming to ASTM B813 and 95/5 solder.

2. Lines 2-1/2" or larger: Make type K copper pipe joints with water soluble flux conforming to ASTM B813 and high melt point silver solder or phos-copper solder.

3. Use no lead solders for industrial water, domestic or potable water piping systems.

C. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.

2. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings, and changes of pipe direction.

D. Welding Joints:

1. Weld all black steel piping 2-1/2" and larger.

2. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

   The qualification test shall show proficiency in overhead, vertical, and horizontal welding techniques. The qualification test shall have occurred within six months prior to performing any welding on this project.

3. Engineer's inspector or authorized representative will review performance qualification records of individual welders.

4. Welding Processes: The following welding processes are permitted, provided that the procedure is qualified in accordance with Section IX, ASME Boiler and Presser Vessel Code.

   a. Manual shielded metal-arc.

   b. Gas tungsten-arc.

   c. Other welding processes may be used providing they are qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code.

5. Restrictions: Weld bevel preparations shall be provided on all welding fittings and shall be machined or ground to remove all discoloration if flame or arc cut.

6. Welding Filler Material:

   a. A filler material control procedure shall be submitted to Owner for review and acceptance prior to performing any welding.

   b. All shielded metal-arc welding shall be performed using low-hydrogen type electrodes such as E7018.

7. Preheat and Interpass Temperature:

   a. Preheat for pressure components shall be as specified in Table 132 of ANSI B.1.

b. Preheat and interpass temperature shall be determined by temperature indicating crayons, contact pyrometers or other equally suitable means.

c. Postweld Heat Treatment: Postweld heat treatment for pressure components shall be as specified in Table 131 of ANSI B31.1.

3.03 PIPE SLEEVES & ESCUTCHEONS

A. Sleeve all pipes passing through masonry or concrete floors and walls. For above ground concrete floors or walls where the opening for the pipe penetration is core-drilled, sleeves may be omitted.

B. Provide piping passing through masonry, concrete, tile and gypsum wall construction with not lighter than 22 gauge galvanized steel sleeves with lock seam, except as otherwise indicated. Sleeves for non-insulated piping passing through gypsum wall construction may be omitted.

C. Sleeves for insulated pipe must be large enough to clear insulation.

D. Where pipe motion due to expansion and contraction will occur, make sleeve of sufficient diameter to permit free movement of the pipes.

3.04 VALVE ACCESS

A. Locate shutoff and control valves for easy access and operation. Where valves are located in enclosed spaces, access doors and installation is under other divisions of these specifications (Division 08). Locate valve at the following locations: Pressure connection to equipment. Branch connections from vertical risers, domestic connections to utilities.

B. Concealment: Unless otherwise indicated, conceal all valves in the finished parts of the building.

C. Grouping: Wherever possible, group valves to provide a neat appearance with all parts accessible.

D. Valves on horizontal piping are to be placed in the upright position only.

3.05 CONTROL SYSTEMS CONNECTORS

A. Weld connectors at points indicated, and at other points where necessary for installation of thermometers and automatic controls.

3.06 RECHECKING AND REPAIRING

A. Before piping is concealed, recheck it for leaks.

B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking, and doping are not permitted.

3.07 CLEANING OF PIPE

A. Before piping is accepted by the Engineer, clean the piping systems as described in Section 23 05 10. Present test results of sterilization to Engineer prior to acceptance of system.

3.08 FIRE STOP MATERIAL

A. Install U.L. assembly at all locations where piping or conduit is stubbed through rated walls and or floors.

3.09 UNIONS, FLANGES AND DIELECTRIC COUPLINGS

A. Unions required: On inlet and outlet of all automatic valves and equipment with connections 2" and smaller.

B. Dielectric Couplings: Provide dielectric couplings at all points where copper or brass pipe or equipment is joined to ferrous pipe and equipment. This requirements does not apply to brass valves in steel lines or joints between copper and cast iron drainage lines.

3.10 PIPE AND VALVE IDENTIFICATION

A. See Section 23 05 00.

END OF SECTION 23 05 28

SECTION 23 05 29

PIPE HANGERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 23 05 00.

B. Contractor shall provide and install pipe hangers and supports for various types of pipe installed as set forth in this section and related sections.

C. Contractor shall provide all intermediate and/or supplementary support steel attached to building structure for piping systems as necessary for support of all piping systems. Attachment of supplementary steel shall be as recommended by building Structural Engineer.

D. When supports, anchorages, and/or seismic restraints for piping are not shown on the drawings, the Contractor shall be responsible for their design and installation.

E. Seismic restraints and anchorages shall resist seismic forces as specified in the latest edition of the International Building Code, for the seismic zone that this project is installed in.

1.02 RELATED WORK

A. Section 23 05 28: Piping and Fitting.

B. Section 23 07 00: HVAC System Insulation.

1.03 SUBMITTALS

A. Submit seven copies of manufacturer's product data for review by the Engineer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers and Supports: Anvil, Fee and Mason, Elcen, Michigan, Kin-Line, Unistrut.

B. Metal Framing Systems (as may be required): Anvil, Unistrut, Superstrut, Kin-Line.

2.02 HANGERS

A. Anvil Figure 260 MSS Type 1, with adjustable clevis hangers, use these for:

1. Non-insulated pipe 2" through 24" diameter.

B. Anvil Figure 104, MSS Type 6, with adjustable swivel ring, split ring fire sprinkler piping hangers shall be UL/FM listed. Use this hanger type for:

1. Non-insulated steel pipe, galvanized steel pipe, and copper pipe ½" through 1-1/2" diameter with 6" long double wrapped poly tape on copper pipe at hanger locations.

C. Anvil Figure CT-69, MSS Type 10, with adjustable swivel ring hanger, either plastic covered or copper plated for non-insulated copper tubing with no longitudinal movement. (Note: Contractor may poly tape copper pipe at hanger locations, 6" long, double thick layer).

D. Anvil Figure CT-121C, MSS Type 8, riser clamps (at floor slab penetrations), use these to support: Copper pipe risers.

E. Anvil Figure 261, MSS Type 8, riser clamps (at floor slab penetrations), use these to support: Steel pipe risers.

F. Trapeze Hangers: Where there are three (3) or more lines of pipe run parallel, support them with trapeze hangers as indicated below:

1. Pipe Size ½" through 4" - No longitudinal movement: "Unistrut" Series #P1001 double channel (length as required - Not to exceed 60"), hanger rod as required for largest pipe size on trapeze, secure pipes with "Unistrut" Series #P2000 pipe/tubing clamps.

   Note: For copper piping provide "Unistrut - Unicushion" isolation material or double wrap copper pipe with "poly" tape, 6" in length at support.

2. Pipe Size ½" through 4" (piping subjected to longitudinal movement): "Unistrut" Series #P1001 double channel (length as required - not to exceed 60"), hanger rod as required for largest pipe size on trapeze. Mount piping on "Unistrut" Series #P2474-1 pipe roller assembly. (Pipe roller to be secured to channel as required per manufacturer's recommendations).

   Note: For copper piping provide "Unistrut - Unicushion" isolation material or double wrap copper pipe with "poly" tape, 8" in length at roller assembly.

3. Pipe Size 6" and Larger: Angle iron 4" x 4" x 1/4" thick (length as required), hanger rods as required for largest pipe size on trapeze. Mount piping on "Anvil" Series #271 pipe roller assembly (pipe roller to be secured with a minimum of two (2) nut/bolt assemblies - drilled through angle iron as required).

4. If insulated pipe, provide as indicated above, except Contractor to provide/install "Anvil" Series #167-MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 PSI). Support piping on outside of insulation.

G. Concrete Inserts: Anvil Figure 282, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load, operating systems.

H. C-Clamps: Anvil Figure 86, MSS Type 23.

1. Use these for attaching hangers to steel beams.

2. Note: Welding hanger rods to steel members is not permitted. Drilling of structural steel is not permitted.

I. Malleable Beam Clamps: Anvil Figure 292, MSS Type 29. Use these for attaching hangers to wide flange beams.

J. Internally Threaded, Heavy-Duty, Steel Expansion Drop-in Anchor: Red Head Multiset II. Use these for attaching hangers to existing overhead concrete floors. Internally threaded anchors shall be reviewed for application with the Project Structural Engineer for applicability/spacing/concrete type/approval prior to installation of any anchors.

PART 3 EXECUTION

3.01 PIPE HANGERS

A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight of pipe.

1. Support pipe risers at regular intervals in pipe shafts in accordance with good practice.

2. Do not use perforated metal, strap iron, or band iron for any pipe support means.

3. Do not make offsets in hangers.

B. Allowable spacing of pipe hangers and rod sizes is listed below. Space hangers and brackets at close intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging.

C. Steel Pipe:

Pipe Size	Hanger Spacing	Rod Size
1/4" - 3/4"	6'-0" O.C.	3/8"
1" - 1-1/2"	6'-0" O.C.	3/8"
2" - 3"	10'-0" O.C.	1/2"
4" - 5"	10'-0" O.C.	5/8"
6" -	12'-0" O.C.	3/4"
7" - 14"	12'-0" O.C.	7/8"

D. Copper Pipe:

Pipe Size	Hanger Spacing	Rod Size
1/4" - 1/2"	5'-0" O.C.	3/8"
3/4" - 1"	6'-0" O.C.	3/8"
1-1/4"	6'-0" O.C.	3/8"
1-1/2" - 2-1/2"	8'-0" O.C.	1/2"
2-1/2"	8'-0" O.C.	1/2"
3" - 4"	10'-0" O.C.	5/8"
5" - 6"	12'-0" O.C.	5/8"

E. Install all clamps, concrete inserts, and steel drop-in anchors per manufacturer's written instructions.

F. Provide all intermediate support steel necessary to bridge joists or structural members and allow for pipe hangers or supports. Under no circumstances shall roof deck or X-Bracing between structural members be used to support piping systems.

G. General: secure all piping in place using approved hangers, supports and anchors designed to support the weight of the pipe, fluid and insulation. Arrange hangers to prevent transmission of vibration from the piping to the building structure, with hangers and supports designed to allow for expansion and contraction. All water piping between outdoor and indoor air conditioning units and fluid cooler and pumps shall be isolated from structure and supports with a minimum of 3/8" thick neoprene enclosed in a minimum 3" long, 26 galvanized steel shield.

H. Pipe Support: Support piping at each change of direction, at ends of branches, at base and top of riser pipes and drops, and wherever necessary to prevent sags, bending or vibration. Spacing between hangers shall not exceed IMC and UPC recommendations. Provide approved pipe stand secured in a permanent manner with an adjustable support. Wood supports of any kind shall not be used.

Insulation Guards: Size hangers on insulated piping to fit outside the covering. Protect insulation from crushing at hanger locations with sheet metal pipe saddles. Use rigid insulation under saddle.

I. Allthread rod used at all suspension points shall be galvanized steel sized to properly bear the weight of the pipe segment.

J. No other piping system is to be attached to each suspension point. Other trades shall not join in attachment to these dedicated suspension or retained assemblies.

K. No attempt has been made to show all the required pipe supports in all locations, either on the drawings or in the details. The absence of pipe supports and details shall not relieve the Contractor of the responsibility for furnishing and installing them as required.

END OF SECTION 23 05 29

SECTION 23 05 32

VALVES

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 23 05 00.

B. Contractor shall provide and install valves of every kind for all Division 23 mechanical piping systems as specified herein and as indicated on the drawings, complete with all unions, supports, handwheels and accessories necessary for fully functional piping systems.

C. For the purpose of establishing the quality and configuration of the valve required, a manufacturer's name and figure number is given hereinafter. Valves of equal quality by other manufacturers, which conform to these specifications, may be submitted for review by the Engineer in accordance with the "submittal section of specification section 23 05 00".

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements.

B. Section 23 05 15: Testing Mechanical Systems.

C. Section 23 05 28: Piping and Fittings.

D. Section 23 07 00: Mechanical System Insulation.

1.03 SUBMITTALS

A. Submit seven copies of all valves for review by the Engineer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ball Valves: Apollo, Hammond, Nibco and Grinnell, Milwaukee, Plast-O-Matic, Hayward, Asashi American.

B. Gate, Globe and Check Valves: Nibco, Milwaukee, Hammond and Grinnell.

C. Gas Valves: Nordstrom-Rockwell, Resun, Milwaukee.

D. Butterfly Valves: Keystone, Center Line, Crane, Grinnell, Hammond, Nibco, Milwaukee, Apollo.

E. Automatic Flow Control Valve: Griswold, Aquaduct, Autoflow, Flow Design.

F. Balancing Valves: Tour and Andersen, Armstrong, Bell and Gossett, NIBCO.

G. Hose Bibb: Woodford, Acorn, Zurn, Smith, Wade.

2.02 **All valves** installed on domestic water system shall be "Fullport" type with working parts of non-corrosive material. (No butterfly valves shall be installed in domestic water systems).

2.03 **VALVES**

A. Gate Valves:

1. Gate Valves - 2-1/2" - 3" (For valves 2" or smaller see Ball Valve): Hammond #IB647, 125# SWP solder joint; body and bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper-silicon alloy stem, brass packing gland, and malleable handwheel.

2. Gate Valves - 4" and larger: Hammond #IR1138 shall be Class 125 iron body, bronze trimmed, with body and bonnet conforming to ASTM A-126, Class B cast iron, 125 lbs., flanged ends, and two-piece packing gland assembly.

B. Non-Slam Check:

1. Size 2" and Smaller: 150 psi SWP bronze body, bronze trim, Hammond #IB945 or approved equal.

2. Size 2-1/2" and Larger: ASTM A126-Class B, 125 psi SWP, non-slam check valve with bronze disc, stainless steel pin, Hammond #IR1124 or approved equal.

C. Globe Valves:

1. Globe Valves (2" and less): Hammond #IB418, 125# SWP solder joint, body and bonnet of ASTM B-62 bronze composition, copper-silicon-bronze stem, brass packing gland, and malleable handwheel.

2. Globe Valves (2-1/2" and larger): Hammond #IR116, Class 125, iron body, bronze trimmed, with body and bonnet conforming to ASTM A-126, Class B cast iron, flanged ends, and two-piece packing gland assembly.

D. Ball Valves (2" and Smaller): Provide Hammond #8614 (Solder ends), or #8604 (Threaded ends), full port three-piece bronze ball valves. Provide with blowout-proof stems, chrome-plated brass ball and stem extension for insulation clearance (where required).

E. Butterfly Valves (Pipe 2-1/2" and Larger): Provide Nibco LCS6822 butterfly valves with PTFE seats in all condenser water. Valves are to be rated for 150# bubbletight service and have meehanite or ductile iron body with threaded lugs, aluminum-bronze disc, 304 stainless steel continuous stem with bronze bushings both side of disc, EPDM replaceable seat suitable for 300°F disc in compression with seat and O-ring stem seats. Provide totally enclosed gear operator with handwheel on all valves 6" and larger. Neck flanges shall clear 2" of insulation.

F. Hose Bibbs: Provide with integral vacuum breaker, T-handle, freeze proof length operator for cities other than Phoenix metro area, non-freeze proof length for Phoenix metro area. Specified in Plumbing Fixtures, Section 22 40 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate valves so as to be accessible by maintenance personnel. Provide wall and/or ceiling access panels as may be required to make accessible.

B. Install accessible valve and union at each equipment connection.

C. Coordinate location of valved outlets for mechanical equipment with Mechanical Contractor.

D. Install chrome-plated escutcheon plates at all wall, floor and ceiling penetrations.

E. Install shutoff valve outside at piping entry into the building. Building valve must be fullway pattern (Full port ball valves on 2" and smaller, gate valve for 2-1/2" and larger).

F. Install all valves per manufacturer's written instructions.

G. Stem valves must be installed upright or no greater than 90° from upright on horizontal piping.

H. All valves installed shall be line size, full port as indicated herein, or as indicated otherwise on the drawings.

I. On all valves with solder ends Contractor shall (at a minimum) make sure that the valve is in the open position prior to soldering. If possible and practical, Contractor shall remove non-metallic seat material prior to soldering procedure.

END OF SECTION 23 05 32

SECTION 23 05 93

AIR DISTRIBUTION AND WATER SYSTEM TEST AND BALANCE

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Contractor shall include in his bid the services of an approved AABC or NEBB certified independent air and water balance and testing agency. A Contract for these services shall be issued to the Testing Agency by the Contractor within thirty (30) days of the Construction Contract being awarded.

B. The testing agency is to balance, adjust and test water equipment and water distributing systems as herein specified.

1.02 RELATED WORK

A. Section 23 05 10: Cleaning Mechanical Systems.

B. Section 23 05 15: Testing Mechanical Systems.

C. Section 23 05 28: Piping and Pipe Fittings.

D. Section 23 05 29: Pipe Hangers.

E. Section 23 21 23: Circulating Pumps.

F. Section 23 65 00: Cooling Tower.

1.03 SUBMITTALS

A. Submit seven (7) copies of the Air-and-Water Balance Report to the Engineer for review one week after the balancing agency completes the field work.

B. Submit within 15 days after receipt of the contract, 7 copies of submittal data for the testing and balancing Cooling Tower and Pumps.

C. The air balance agency shall provide proof of having successfully completed at least five projects of similar size and scope and shall be a certified member of Associated Air Balance Council or National Environmental Balance Bureau.

D. Submit calibration information on all instruments for use on the project. See paragraph 2.03.

E. Submit the test and balance contract to the Engineer for approval within 90 days after the Air Conditioning Contractor has received his contract to proceed with the air conditioning installation to allow the air balance agency to schedule this work in cooperation with other trades involved and comply with the completion date.

PART 2 PRODUCTS

2.01 ACCEPTABLE AIR BALANCE AGENCIES: TAB Technology, Inc., Technical Air Balance, Precision Air Balance, Arizona Air Balance.

2.02 **INSTRUMENTS: All instruments used by this agency shall be accurately calibrated and maintained in good** working order. As a minimum the following or an equal shall be owned and used by the Balance Agency Contractor.

A. Davis Type A-2, 4" vane anemometers.

B. Dwyer Model 170 air velocity gauges.

C. Dwyer Model 400-10 incline vertical manometers.

D. Alnor Model 2205 magnehelic gauges.

E. Bacharah sling psycorometers.

F. Test thermometers.

G. Amprobe ammeters

H. General Radio 1531 A.B. Strobotac.

I. Annie A-8 four-point temperature analyzers.

J. Compound test gauges.

K. Barton Model 247 flow indicators.

L. Carbon dioxide indicator fyrite.

M. Smoke bombs.

N. Two-way radios.

O. Quest sound meter with octave bank analyzer.

P. Shortridge Instruments flow hoods.

Q. Data Metrics hot wire anemometers.

R. Data Metrics electronic rotating vane anemometers.

S. Electronic thermometers.

T. Shortridge Instruments electronic micromanometer.

U. Water flow meters.

V. Water pressure gauges.

PART 3 EXECUTION

3.01 COORDINATION

A. Do not begin air balance, testing or air sampling until system has been completed and is in full working order. New filters must be installed by the Mechanical Contractor previous to balance work.

B. Put all heating, ventilating and air conditioning systems and equipment into full operation and continue the operation of same during each working day of testing, and balancing.

3.02 BALANCING

A. Upon completion of the air conditioning system, the air balance agency shall perform the following test, compile the test data, and submit seven (7) copies of the complete test data to the Contractor for forwarding to the Engineer for review and approval, including dates, time, personnel, status of operating of cooling or heating.

B. Testing Procedure: As a minimum the air and water balance agency shall perform the following tests, and balance system as follows:

1. Test and adjust blower RPM to be within 5% of design requirements.
2. Test and record motor full load amperes.
3. Make pitot tube traverse of main supply ducts and obtain design CFM at fans when deemed necessary by the Engineer.
4. Test and record system static pressure, suction and discharge, fan total static pressure, and pressure drop across components.
5. Test and adjust system for design CFM outside air.
6. Test and adjust system for design CFM recirculated air.
7. Test and record entering air temperatures (DB heating and cooling).
8. Test and record entering air temperatures (WB cooling).
9. Test and record leaving air temperatures (DB heating and cooling).
10. Test and record leaving air temperatures (WB cooling).
11. Adjust all main supply and return air ducts to proper design CFM.
12. Adjust all zones to proper design CFM supply and return.
13. Test and adjust each ceiling diffuser, grille and register to within 10% of design requirements while still maintaining required pressure relationships.
14. Each grille, diffuser and register shall be identified as to location and area on a set of plans included with report.
15. Identify and list size, type and manufacture of diffusers, grilles, registers and all tested equipment. Use manufacturer's ratings on all equipment to make required calculations.
16. Reading and tests of diffusers, grilles and registers shall include required velocity, required CFM, and test resultant CFM after adjustments.

17. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated and/or noted.

18. Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

19. Check and record the amperage of each electric strip heater.

20. As part of the work of this contract, the Air Conditioning Contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for corrected balance as recommended by air balance agency, at no additional cost to Owner.

21. The balance agency shall provide approved instrumentation to conduct the tests and balance all water flows. Adjust water flows to all coils and equipment to the specified amounts as shown on the plans. The balance agency shall use a portable field flow meter and the Air Conditioning Contractor shall provide 3/4" corporation stop cock on inlet and outlet side of coils and equipment. Air Conditioning Contractor shall consult with balance agency as to type and location of required fittings. Stop cocks or Petes plugs shall be located as close to actual coil entering and leaving as possible, so as not to take in any additional pressures caused by valves, elbows, etc.

    Prior to construction of piping systems, air conditioning contractor shall install these corporation stop cocks at his own expense should he fail to install them during the system construction prior to the water balance time.

22. The Balance Agency shall field verify each of the flow control valves at each equipment item requiring water flow, i.e., fluid cooler, exhaust fan, heat pump unit, and as indicated on the drawings. The flow data and the model/manufacturer of each flow controller shall be indicated in the balance report.

23. The Contractor shall furnish the necessary labor to assist the testing agency to complete its work.

24. The Contractor shall furnish an automatic temperature controls, factory trained and authorized start-up man to assist the balance agency in operation of controls as required by the balance agency.

25. Test and balance agency shall include an extended warranty (in addition to the one year guarantee period) of 90 days after completion or resetting of any outlet, supply air fan or exhaust fans as listed in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

END OF SECTION 23 05 93

SECTION 23 21 23

CIRCULATING PUMPS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install the circulating pumps for the watersource heat pump systems with all accessories, hardware and controls specified and shown on the drawings, complete and fully functional.

B. All work specified in this section shall comply with the provisions of Section 23 05 00.

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements.

B. Section 23 05 10: Cleaning Mechanical Systems.

C. Section 23 05 15: Testing Mechanical Systems.

D. Section 23 05 28: Pipe and Fittings.

E. Section 23 05 29: Pipe Hangers.

F. Section 23 05 32: Valves.

1.03 SUBMITTALS

A. Submit seven copies of all pumps for review by the Engineer.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Armstrong, Bell & Gossett, Taco, Paco, Patterson, Peerless, Grundfos.

2.02 IN-LINE PUMPS

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be end suction, close coupled or frame mounted.

B. Pump casing shall be of Class 30 cast iron. The impeller shall be of cast bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew.

C. Pump casings and impeller for domestic hot water use shall be of stainless steel or cast bronze.

D. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F. A bronze shaft sleeve shall completely cover the wetted area under the seal.

E. Pumps shall be rated for minimum of 175 psi working pressure. The pump case shall have gauge tappings at the suction and discharge nozzles and will include vent and drain ports.

F. Motor shall meet the requirements of Section 23 05 13 and shall be the size, voltage and enclosure called for on the plans. The motor shall have heavy-duty ball bearings, completely adequate for the maximum load to which the pump is applied.

G. Mounting: Adhere to the pump manufacturer's installation instructions.

H. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

PART 3 EXECUTION

3.01 ALIGNMENT - BASE MOUNTED PUMPS

A. The pump shall be mounted on this level base and then aligned using a dial indicator (regardless of whether the pump and motor have been factory aligned). Alignment must be made prior to installation of connecting piping.

1. Grouting and Final Alignment: After alignment, piping connections are to be made and the base thoroughly grouted. After all bolts are tightened grout base with grout, Hallemite Por-Rok expanding grout or approved equal. The pump and motor are to be aligned again using a dial indicator. After a run-in period of one week, the alignment is to be checked and the pump and motor to be aligned again if required. All pumps and motors 10 hp and larger shall then be dowel-pinned with a minimum of 2 pins in motor and 2 in pump base.

3.02 WATER PIPING

A. Arrange and support all piping so that absolutely no weight of the piping rests on the pump flanges. Alignment for final piping connection shall be such that slip-fit is allowed. Should it be necessary to force the bolts, the piping shall be taken down and rearranged to allow the proper fit.

END OF SECTION 23 21 23

SECTION 23 65 00

COOLING TOWERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. All work specified in this section shall comply with the provisions of Section 23 05 00.

B. Contractor shall provide and install the fluid coolers as shown on the drawings and specified herein. Cooling Tower shall be complete with all hardware, piping connections, controls, electrical connections, plumbing connections, and supports as necessary for a fully functional Cooling Tower in the Water Cooled A/C System.

C. Contractor shall provide all intermediate support steel attached to building structure as necessary for support of all cooling towers, pumps and piping systems.

1.02 RELATED WORK

A. Section 23 05 00: General HVAC Requirements.

B. Section 23 05 10: Cleaning Mechanical Systems.

C. Section 23 05 15: Testing Mechanical Systems.

D. Section 23 05 28: Piping and Fittings.

E. Section 23 05 29: Pipe Hangers.

F. Section 23 21 23: Circulating Water Pumps.

1.03 SUBMITTALS

A. Submit seven copies of manufacturer's product data for review by the Engineer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Baltimore Air Coil, Evapco.

2.02 COOLING TOWER

A. Unit shall be factory assembled cooling tower of induced draft counterflow design, with side air entry and vertical air discharge.

B. All construction shall be stainless steel.

C. The cooling tower shall have a size and capacity as noted on the drawings.

D. Casing: Corrosion Resistant Type 304 Stainless Steel Construction: All steel panels and structural members shall be constructed of Type 304 stainless steel and assembled with Type 304 stainless steel nut and bolt fasteners.

E. Cold Water Basin: The cold water basin shall be constructed of heavy-gauge Type 304 stainless steel panels and structural members up to the heat transfer section/basin joint. All factory seams in the cold water basin shall be welded to ensure watertight assembly and welded seams shall be warranted against leaks for five (5) years. Standard basin accessories shall include: a corrosion resistant make-up valve with large diameter polystyrene filled plastic float for easy adjustment of the operating water level, removable anti-vortexing device to prevent air entrainment, and large area lift out strainers with perforated openings sized smaller than the water distribution system nozzles. A bolted Type Series 300 stainless steel basin shall not be an acceptable alternative.

F. Air Inlet Louver Screens: All louvers shall be constructed from PVC. Louver sections shall be individually removable in 12" wide (maximum) sections, allowing for quick and easy access to any part of the cold water basin without the need for tools. Louvers shall prevent debris from entering the cold water basin as well as preventing splashout. Louvers which are greater than 12" wide or require tools for removal shall not be an acceptable alternate.

G. Rigging: The cooling tower shall be designed and constructed to withstand rigging of the casing and cold water basin as a single piece.

H. Casing Field Joint: The heat transfer section shall be joined to the lower section without the use of a gasket or sealer. The field joint shall be self-aligning and require a minimum number of fasteners.

I. Heat Transfer Section: The heat transfer section(s) shall consist of fill, spray water distribution system and drift eliminators arranged for optimal thermal performance with minimal drift.

J. Fill: The fill shall be formed from self-extinguishing polyvinyl chloride (PVC) having a flame spread rating of 25 per ASTM E84 and shall be impervious to rot, decay, and fungus or biological attack. The fill shall be suitable for use as a working platform, and shall be provided and performance tested by the cooling tower manufacturer to assure single source responsibility and control of the final product. The fill shall be able to withstand a water temperature of 140°F (60.0° C).

K. Water Distribution System: Water shall be distributed evenly over the fill by a water distribution system consisting of a header and spray branches of Schedule 40 PVC pipe with large orifice, non-clog plastic distribution nozzles. The headers shall have a removable cap facilitating quick header cleanout without removal. The spray nozzles shall be held in place by snap-in rubber grommets and the branches should be removable without tools or removal of branch supports , allowing quick removal of individual nozzles or complete branches for cleaning or flushing. Branches that require tools for removal or removal of branch supports shall not be an acceptable alternative.

L. Drift Eliminators: Eliminators shall be constructed of specially formulated PVC and be removable in easily handled sections. They shall have a minimum of three changes in air direction.

M. Fan(s): Fan(s) shall be low sound "Whisper Quiet", axial flow with corrosion resistant blades selected to provide optimum cooling tower thermal performance with reduced sound levels. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum tip clearance for maximum fan efficiency. The top of the fan cylinder shall be equipped with a conical, non-sagging removable fan guard. The fan(s) and fan drive system, including the fan motor, shall be factory test-mounted and aligned to ensure reliable operation and ease of maintenance.

N. Bearings: Fan(s) and shaft(s) shall be supported by heavy-duty, self-aligning, grease packed ball bearings with moisture proof seals and integral slinger collars, designed for L- 10 80k Life. Extended bearing lube lines shall be terminated at the access door for ease of maintenance, and shall require opening the access door to insure proper lubrication.

O. Fan Drive: The fan(s) shall be driven by a one-piece, multi-groove, solid back V-type powerband with taper lock sheaves designed for 150% of the motor nameplate horsepower. The powerband shall be constructed of neoprene reinforced polyester cord and be specifically designed for cooling tower service.

P. Sheaves: Fan and motor sheave(s) shall be fabricated from corrosion-resistant materials to minimize maintenance and ensure maximum drive and powerband operating life.

Q. Fan motor(s) shall be premium efficient/VFD duty, totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type designed specifically for cooling tower service. Fan motor(s) shall be designed per NEMA Standard MG1, Section IV Part 31, Section IV, and Part 31 suitable for 460 volt, 60 hertz, and 3 phase electrical service. The motor(s) shall be furnished with special moisture protection on winding, shafts, and bearings, and appropriately labeled for "cooling tower duty." Motor(s) shall be mounted on an interior, adjustable base which allows the motor to slide to the exterior of the unit for servicing. A mechanical equipment removal davit mounting channel shall be included as standard and integral to the casing design. Motor adjustments shall be made from the exterior of the unit; internally adjustable motor bases shall not be an acceptable alternative.

R. Mechanical Equipment Warranty: The fan(s), fan shaft(s), bearings, mechanical equipment support and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

S. Tower Access: Permanently mounted, inward sliding access doors are provided for safe and easy access to the spray branch and fan drive system for routine maintenance. Removable access doors are not acceptable.

2.03 SOUND

A. Sound Level: To maintain the quality of the local environment, the maximum sound pressure levels (dB) measured 50 ft from the cooling tower operating at full fan speed shall not exceed the sound levels detailed below.

	Center Frequency (Hertz)								A-wgtd
Location	63	125	250	500	1000	2000	4000	8000	dB(A)
Discharge	60	58	54	52	52	50	49	49	58
Air Inlet	62	56	52	52	52	52	52	52	59
Motor Side	66	59	52	54	52	52	52	52	59

2.04 ACCESSORIES

A. Vibration Cutout Switch: Provide mechanical local reset vibration switch. The mechanical vibration cut out switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be a frequency range of 0 to 3,600 RPM and a trip point of 0.2 to 2.0 g's.

B. Basin Sweeper Piping: The cold water basin of the cooling tower shall be equipped with PVC basin sweeper piping for a filter or separator (supplied by others).

C. Water Silencers: The unit shall be equipped with PVC water silencers in the cold water basin to reduce falling water sound emissions.

D. External Access – Access Door Platform: An external galvanized steel access platform at the access door of the unit(s) provides access to the spray distribution system. An aluminum ladder and 1-1/4" (32 mm) galvanized steel pipe safety railing is included with the platform. Field installation is by others. This option meets pertinent OSHA standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Cooling Tower as shown on the drawings and specified herein.

B. Install fluid cooler per the manufacturer's written instructions.

END OF SECTION 23 65 00

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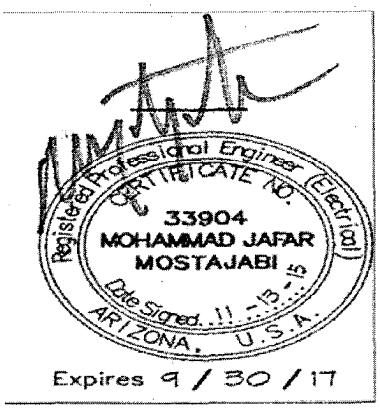

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This specification describes, in general, requirements of the electrical and related items of work necessary for a complete and operable installation of equipment and systems as contained in the contract documents.

B. The provisions of this section are applicable to all sections and any other applicable portions of the contract documents.

1.02 WORK SPECIFIED HEREIN

A. The work included in this section includes furnishing of all material, labor, tools, appliances and equipment, except as furnished under other sections of the specifications or as noted on the drawings, necessary to install all electrical work, including that which is reasonably inferred for a complete and operable system.

B. The work shall include but not be necessarily limited to:

1. Electrical distribution system including switchgear, panels, transformers, etc. along with feeders as indicated and required.

2. Lighting fixtures and lamps.

3. Switches, receptacles and coverplates.

4. Branch circuit wiring to all new and existing equipment, fixtures, motors, control system, etc. as indicated and required.

5. Special system equipment, boxes, conduit, cabling, coverplates and terminations as indicated and required.

6. Final connection of Owner furnished equipment and equipment furnished by others.

7. Control systems conduit, cabling and terminations, unless specified as included elsewhere, as indicated and required.

1.03 REGULATIONS AND STANDARDS

A. All work shall be performed in accordance with codes and standards stated herein and such regulations and standards, as specified in other sections or enforced by local jurisdiction. If a conflict occurs between the Contract Documents, regulations and standards, the more stringent shall take precedence.

B. Current editions of the following shall apply:

1. NFPA 70 - National Electrical Code (NEC)

2. State, County or other local Codes
3. NFPA 101 - Life Safety Code
4. Uniform Building Code (UBC)
5. National Electrical Manufacturers' Association (NEMA)
6. Underwriter's Laboratories, Inc. (UL)
7. American Standards Association (ASA)
8. Occupation Safety and Health Standards (OSHA)
9. Americans with Disabilities Act (ADA)
10. National Energy Policy Act (NEPA)

1.04 PERMITS, INSPECTIONS, FEES

A. Unless specifically addressed elsewhere in these specifications, obtain and pay all fees for permits, inspections, utilities, etc. required for performance of work described in this section of the specifications.

1.05 DRAWINGS

A. The drawings are generally diagrammatic but shall be followed as closely as actual construction allows and work of other trades permits.

B. Before proceeding with work check and field verify dimensions and clearances to ensure proper spacing is maintained.

C. Coordinate all work with other trades prior to installation. Notify Architect in writing of any conflicts prior to commencing work in the area in question.

D. Contractor shall correct and/or remove work in conflict at his expense if proper notification is not received.

1.06 MATERIALS AND WORKMANSHIP

A. All material and equipment furnished for this project shall be new unless otherwise noted and bear approval labels of UL or other recognized testing agency.

B. Installation methods and workmanship shall be in full accordance with latest and approved electrical trade practices.

1. Manufacturer's recommended installation procedures shall be followed in all cases when the installation procedures cover points not covered in the drawings or these specifications.

2. The Engineer reserves the right to direct any work to be removed and reinstalled for which, in his opinion, the workmanship is not in keeping with the standards of this craft.

C. Where there appears to be a discrepancy in the drawings and/or the specifications, the Contractor shall figure the most expensive alternative and after award of Contract, shall secure directions from the Architect.

D. All work is to be executed in a manner to provide safe and lawful ingress and egress to the Owner's establishment. The facility shall be kept clear of hazards to avoid injury or damage to any and all persons or property.

E. Temporary power and lighting for construction purposes shall be as specified in the General Conditions.

1.07 SUBMITTALS/SHOP DRAWINGS

A. Submit items to Architect. Submittals/Shop Drawings are required for specific items of material and equipment as listed in the individual sections of these specifications.

1. Submittals/Shop Drawings are for information and coordination only. The items submitted will be diligently reviewed to attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval and does not remove the responsibility from the Contractor, his obligation to comply with all project requirements.

2. Submittals/Shop Drawings are not to be construed as Contract Documents. Any failure to note a point of non-compliance during review shall not be construed as an acceptance of or approval of the discrepancy.

3. All required Submittals/Shop Drawings shall be submitted in a timely manner to insure no delay in the schedule of completion of the project.

B. Submit seven (7) copies of all items requiring submission by these specifications.

1. Each copy of submittals shall be bound and shall include a signed statement from the Contractor certifying that the submittal has been reviewed by the Contractor and does satisfy the project requirements.

2. Submit all Submittals/Shop Drawings at the same time.

C. In case of substitutions, the Contractor shall include clearly marked engineering data on both the specified items and the substituted item. In some cases, as deemed proper by the Engineer, table top comparisons of both specified and proposed substitute items may be required.

1. If so requested, the Contractor shall deliver each of the two (2) items in fully functioning condition to a location as directed by the Architect and/or Engineer.

2. Specified and proposed substitute items shall be provided at the Contractor's expense.

1.08 REQUESTS FOR INFORMATION (RFI'S)

A. Contractor shall submit RFI's to allow a minimum of ten (10) business days for Engineer's review time.

B. Contractor shall provide a "proposed solution" for each RFI submitted.

C. Each RFI submitted shall contain only one (1) item.

1.09 CUTTING, PATCHING AND SLEEVES

A. Cutting, patching or channeling of finished surfaces is prohibited without the prior consent and directions of the Architect.

1. Cutting and patching is to be done by craftsmen skilled in the required trades.

2. No cutting or patching shall impair the strength, function or esthetics of work being cut, and structural members are not to be weakened. Holes through exterior walls and ground floor are to be water-proofed and patches in finished surfaces are to be invisible.

3. Penetrations through fire barriers are to be sealed with approved firestopping materials.

1.10 PAINTING

A. Provide a prime coat of paint for unprotected supports, hangers, frames and similar items furnished and installed under this division.

1. Panels and cabinets shall have a standard factory finish.

1.11 STORAGE OF MATERIAL

A. All equipment and material for this project that is stored on the site shall be protected from the weather in a manner acceptable to the Architect.

1. Arrange for the timely delivery of material to site in order to minimize exposure to the elements and other undesirable conditions.

2. All material shall be stored off the ground to ensure that no dirt or debris is allowed to contaminate them before installation. Failure to store material correctly shall be just cause for the Architect to direct the Contractor to remove the material from the site.

B. All items removed during demolition shall be disposed of or stored as indicated and required by the drawings and specifications or as directed by the Owner.

1.12 TEST AND ADJUSTMENTS

A. Test and adjustments shall be made upon completion and prior to final acceptance.

1. Equipment or wiring which tests prove to be defective, damaged, or operating improperly will be corrected or replaced promptly, at no additional cost to the Owner.

2. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it. When inspected, tested and approved, restore all work to original proper condition.

3. Pay the cost of testing, including replacement of damaged equipment resulting from testing.

B. Contractor shall demonstrate to the Owner and operating personnel, all essential features of all systems and instruct them in the proper operation and maintenance of such systems.

1. Arrange for the Owner and Manufacturer's Representatives of the system to be present during the demonstrations.

2. Arrange with the Owner's Representative the time for performing the demonstrations.

C. Upon completion of all demonstrations and instructions, submit to the Architect, a signed statement certifying that all demonstrations and instructions have been completed. The statement shall be countersigned by the Owner.

1.13 RECORD DRAWINGS

A. Maintain, at the project a set of drawings on which daily record of changes and deviations from contract documents shall be recorded.

1. All concealed conduit 1-1/4" and larger shall be located with reference to the drawings (i.e. columns, etc.) by dimensions on these drawings.

2. Include all pertinent information necessary to perform maintenance and possible future renovations.

3. Record Drawings shall be made available to the Architect or his representatives as required for periodic review.

4. Final Record Drawings with all information clearly and legibly recorded shall be delivered by the Contractor to the Owner and the Architect at the completion of the project.

1.14 OPERATING AND MAINTENANCE MANUALS

A. Three sets of the following data are required:

1. Operating and maintenance instructions prepared in accordance with Division 1 of these Specifications.

2. Recommended spare parts lists.

3. Illustrated parts breakdown for each piece of equipment.

4. Copies of approved submittal data.

5. Supply house name and address, supply house phone number and contact person for each item of equipment for future parts procurement.

6. Equipment warranties.

7. Control wiring diagrams, operating sequences, and devices literature.

8. Certified copies of all test reports.

9. Project warranty letter.

B. Arrange each set of data in an orderly way, and bind each set in a separate three-ring, hard cover binder.

1.15 CLEANING

A. In addition to cleanup specified elsewhere in this specification, thoroughly clean all parts of equipment furnished under this Division.

1. Clean off all spattered construction material and remove all oil and grease spots.

2. Keep premises free from accumulation of waste materials and rubbish.

B. Metal floor pans are to be provided for pipe threading machines and benches and will be used at all times to prevent concrete floors from becoming oil soaked.

C. Upon completion, remove all debris, clean all switch plates, fixtures, panel trims, etc. Leave the premise in a clean condition.

1.16 PROJECT CLOSEOUT

A. Upon completion of the project the following procedure shall be followed:

1. Walk-through inspection by Engineer, Owner and Contractor. Any discrepancy noted shall be corrected before project is closed.

END OF SECTION 26 05 00

SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

1.02 RELATED SECTIONS

A. Section 26 05 33 - Conduit.

B. Section 26 05 33.B - Boxes.

C. Section 26 05 53 - Identification.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 SUBMITTALS

A. Submit manufacturer's standard data for products furnished under this section in accordance with Section 26 05 00 and Division 01.

1.06 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper unless indicated otherwise on Drawings.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.07 COORDINATION

A. Coordinate Work under provisions of Section 26 05 00 and Division 01.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - BUILDING WIRE AND CABLE

A. Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work included but not limited to the following:

1. American Insulated Wire Corp.
2. General Cable Corp.
3. Southwire Company.

2.02 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper unless indicated otherwise on Drawings.

C. Insulation Voltage Rating: 600 volts.

D. Solid Conductor #10 and Smaller, stranded for #8 and larger unless noted otherwise elsewhere in Specifications or on Drawings.

2.03 NONMETALLIC-SHEATHED CABLE

A. Shall not be used.

2.04 ARMORED CABLE

A. Shall not be used.

2.05 METAL CLAD CABLE

A. Shall not be used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRE TYPES

A. Type THWN or XHHW: Used for panel, equipment feeders and branch circuits.

B. Type THHN or XHHW: Used for all lighting and receptacles circuits, motors in

mechanical equipment rooms, and for similar circuits in other high ambient temperature areas. No. 12 stranded is to be used where lighting branch circuit conductors are routed through fluorescent fixture channels.

C. Type SFF-2 (150 Degree C): Minimum size No. 14 stranded, use for field tap-off connections to incandescent fixture sockets, and other high operating temperature equipment connectors, where operating temperature exceeds 90 degrees C.

3.04 INSTALLATION

A. All conductors shall be installed in conduit.

B. Install products in accordance with manufacturers instructions.

C. Use stranded conductors for control circuits.

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Use conductor not smaller than 16 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet to first device. Conductor shall be same size for complete circuit.

G. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet to first device. Conductor shall be same size for complete circuit.

H. Pull all conductors into raceway at same time.

I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

J. Neatly train and lace wiring inside boxes, equipment, and panelboards.

K. Clean conductor surfaces before installing lugs and connectors.

L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

M. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.

N. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 26 05 53.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.06 FIELD QUALITY CONTROL

A. Inspect for physical damage and proper connection.

B. Ensure correct torque of bolted connections.

C. Verify continuity of each branch circuit conductor.

3.07 COLOR CODING

A. Each conductor shall be identified as follows throughout the system:

	120/208 Volt	277/480 Volt
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Grey
Ground	Green unless Bare Copper is specifically stated in drawings	Green unless Bare Copper is specifically stated in drawings
Isolated Ground	Green with yellow stripe	Green with yellow stripe

B. Conductor insulation to be color coded in sizes up through No. 8. Conductors No. 6 and larger, with black insulation, color code with ½" band of colored tape at all junctions and terminations.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.02 RELATED SECTIONS

A. Section 26 05 19 - Building Wire and Cable.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Size: As indicated on Drawings.

2.02 MECHANICAL CONNECTORS

A. Manufacturer(s):

1. Burndy.
2. T & B.
3. Appleton.
4. Substitutions: Prior Approved Equal.

B. Material: Bronze.

2.03 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Cadweld.

2. Thermoweld.

2.04 WIRE

A. Material: Insulated, stranded copper. (XHHW) where not in contact with earth and Bare stranded copper where in contact with earth.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

B. Verify that all exothermic welds are complete and mechanical connections are tight.

3.02 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install rod electrodes at locations indicated. Drive Rods until Tops are 2 inches below finished floor or final grade unless noted otherwise.

C. Install 4 AWG bare copper wire in foundation footing, minimum 20 Feet long.

D. Provide bonding to meet Regulatory Requirements.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Install ground grid under access floors where indicated. Construct grid of 2 AWG bare copper wire installed on 24 inch centers both ways unless indicated otherwise on the drawings. Bond each access floor pedestal to grid.

G. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use 2 AWG bare copper conductor.

H. Provide separate isolated grounding conductor for branch circuits supplying isolated ground and surge type receptacles.

I. Provide all flexible conduit with a jumper wire sized to the ampacity of the branch breaker. Flexible conduit will not be approved as achieving continuity of ground, even if listed or labeled, without the called for jumper.

J. The secondary neutral of all 480 Volt - 208/120 Volt transformers shall be grounded with a bare copper grounding electrode conductor sized in accordance with Article 200 of NEC.

K. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.03 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION 26 05 26

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.03 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use expansion anchors, powder actuated anchors (when specifically approved only) and preset inserts.

2. Steel Structural Elements: Use beam clamps.

3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.

5. Solid Masonry Walls: Use expansion anchors and preset inserts.

6. Sheet Metal: Use sheet metal screws.

7. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

F. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 05 29

SECTION 26 05 33.A

SURFACE RACEWAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface metal raceways.

B. Multi-outlet assemblies.

C. Wireways.

D. Wall duct.

1.02 RELATED SECTIONS

A. Section 26 27 26 - Wiring Devices: Receptacles.

B. Section 26 05 26 - Grounding and Bonding.

C. Section 26 05 29 - Supporting Devices.

1.03 REFERENCES

A. NECA (National Electrical Contractor's Association) Standard of Installation.

B. NEMA WD 6 - Wiring Device Configurations.

1.04 SUBMITTALS

A. Submit manufacturer's data for products furnished under this section in accordance with Section 26 05 00and Division 01.

B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 and Local Amendments.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 SURFACE METAL RACEWAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiremold.
2. Panduit.
3. Square D.

B. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. Size: As shown on Drawings.

D. Finish: Manufacturer's standard finish unless noted otherwise on Drawings.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.

2.02 MULTIOUTLET ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiremold.
2. Panduit.
3. Square D.

B. Multioutlet Assembly: Sheet metal channel with fitted cover, suitable for use as multioutlet assembly.

C. Size: As indicated on the Drawings.

D. Receptacles: Provide covers and accessories to accept devices as indicated.

E. Receptacle Spacing: As indicated.

F. Channel Finish: As indicated.

G. Fittings: Furnish manufacturer's standard couplings, elbows, and connectors.

2.03 WIREWAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiremold.
2. Panduit.

3. Square D.

B. Description: General purpose, oiltight and dusttight or Raintight type wireway. As indicated.

C. Size: As indicated.

D. Finish: Rust inhibiting primer coating with gray enamel finish.

PART 2 - EXECUTION

3.01 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wireway Supports: Provide steel channel as specified in Section 26 05 29.

E. Close ends of wireway and unused conduit openings.

F. Ground and bond raceway and/or wireway under provisions of Section 26 05 26.

END OF SECTION 26 05 33.A

SECTION 26 05 33.B

BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Floor boxes.

C. Pull and junction boxes.

1.02 RELATED SECTIONS

A. Section 26 27 26 - Wiring Devices.

B. Section 26 05 33.C - Cabinets and Enclosures.

1.03 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

D. ANSI/NFPA 70 - National Electrical Code.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.04 SUBMITTALS

A. Submit manufacturer's standard data for products furnished under this section in accordance with Section 26 05 00 and Division 01.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of floor boxes and outlets prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Architect/Engineer shall have option to relocate within 10 feet of location shown prior to initial installation without additional costs to Owner or Architect/Engineer.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.02 FLOOR BOXES

A. Floor Boxes: ANSI/NEMA OS 1, fully adjustable.

B. Material: Cast metal.

C. Conform to regulatory requirements for concrete-tight floor boxes.

2.03 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting.

1. Material: Brass.

2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

3. Cover Legend: To match system in which installed.

C. Fiberglass Handholes: Die-molded fiberglass handholes.

1. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.
2. Cover: Fiberglass weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished accessible areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

O. Use gang box where more than one device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. Use cast outlet box in exterior locations and wet locations.

R. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

S. Set floor boxes level.

T. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

1. Use hinged enclosure under provisions of Section 26 05 33.C.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access panels with other trades. Provide access panels where required for proper access.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes with Architect.

D. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.03 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closure in unused box opening.

END OF SECTION 26 05 33.B

SECTION 26 05 33.C

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hinged cover enclosures.

B. Cabinets.

C. Terminal blocks.

D. Accessories.

1.02 RELATED SECTIONS

A. Section 26 05 29 - Supporting Devices.

1.03 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.

C. ANSI/NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Submit manufacturer's standard data for products furnished under this section in accordance with Section 26 05 00 and Division 01.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 EXTRA MATERIALS

A. Provide two (2) of each cabinet key.

1. Key all cabinets alike.

PART 2 - PRODUCTS

2.01 CABINETS AND ENCLOSURES

A. Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work included but not limited to the following:

1. B-Line.

2. Hoffman Engineering, Co.

3. Killark Electric Mfg. Co.

2.02 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type as indicated on Drawings.

B. Covers: Continuous hinge, held closed by flush latch operable by key.

C. Provide interior plywood panel for mounting terminal blocks and electrical components; paint matte white.

D. Enclosure Finish: Manufacturer's standard enamel.

2.03 CABINETS

A. Boxes: Galvanized steel.

B. Box Size: As indicated on Drawings.

C. Backboard: Provide 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.

D. Fronts: Steel, with concealed hinge, and flush lock. Finish with manufacturer's standard enamel.

E. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.

F. Provide accessory feet for free-standing equipment.

2.04 TERMINAL BLOCKS

A. Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work included but not limited to the following:

1. Allen-Bradley.

2. AMP, Inc.

3. Anixter Bros., Inc.

B. Terminal Blocks: ANSI/NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

C. Install cabinet fronts plumb.

END OF SECTION 26 05 33.C

SECTION 26 05 33

CONDUIT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquidtight flexible metal conduit.

D. Electrical metallic tubing.

E. Nonmetal conduit.

F. Fittings and conduit bodies.

1.02 RELATED SECTIONS

A. Section 26 05 26 - Grounding and Bonding.

B. Section 26 05 29 - Supporting Devices.

C. Section 26 05 33.B - Boxes.

D. Section 26 05 43 – Excavation, Trenching and Backfill.

E. Section 26 05 43.A – Underground Conduit Systems.

F. Section 26 05 53 - Electrical Identification.

1.03 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70 and Local Amendments.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 1 inch.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 and Local Amendments.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide

appropriate covering.

C. Protect PVC conduit from sunlight.

1.07 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

1.08 SUBMITTALS

A. Submit manufacturer's standard data for products furnished under this section in accordance with Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: Typically 3/4 inch unless otherwise specified.

B. Underground Installations:

1. Use Schedule 80 or Schedule 40 nonmetallic conduit.

2. Minimum Size: 3/4 inch.

C. Outdoor Locations, Above Grade: Use rigid steel conduit, and intermediate metal conduit.

D. In Slab Above Grade:

1. Use Schedule 80 or Schedule 40 nonmetallic conduit.

2. Maximum Size Conduit in Slab: 3/4 inch.

E. Wet and Damp Locations Above Grade: Use rigid steel conduit, intermediate metal conduit and electrical metallic tubing.

F. Dry Locations:

1. Concealed: Use intermediate metal conduit, electrical metallic tubing.

2. Exposed: Use rigid steel conduit and intermediate metal conduit.

2.02 MATERIALS

A. Rigid Metal Conduit/Intermediate Metal Conduit.

1. Hot dipped galvanized rigid steel meeting ANSI C80.1 and ASTM A153. Conduit shall bear UL Label.

2. Fittings and Conduit Bodies shall meet ANSI/NEMA FB1. Material shall match conduit.

3. Approved Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work shall include but not limited to the following:

   a. Allied Tube and Conduit.
   b. Wheatland Tube Company.
   c. Western Tube & Conduit.

B. Electrical Metallic Tubing (EMT)

1. Galvanized Steel Meeting ANSI C80.3. Conduit shall bear UL Label and be marked with manufacturer's name.

2. Fittings for damp or wet locations shall be of the regular watertight design, with hexagonal nuts and center portions requiring the use of a wrench during installation. Set screw type fittings are permitted in dry locations only. Dye cast fittings are not acceptable.

3. Approved Manufacturers:

   a. Allied Tube and Conduit.
   b. Wheatland Tube Company.
   c. Western Tube & Conduit.

C. Nonmetallic Conduit

1. Polyvinyl Chloride (PVC) conduit, Schedule 40 or 80 meeting NEMA TC-2. Conduit shall bear UL Label and manufacturer's name.

2. PVC Fittings for use with Rigid PVC conduit meeting NEMA TC-3.

3. Approved Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work include but not limited to the following:

   a. Carlon.
   b. Cantex.
   c. PW Pipe.

D. Flexible Metal Conduit

1. Provide flexible metal conduit for the termination at equipment subject to motion and/or vibration.

2. Flexible interlocked steel type in dry locations with squeeze type steel connectors.

3. Flexible interlocked steel with PVC jacket in wet locations with watertight ferrule and sleeve type steel connectors.
4. Length shall not exceed 6 Feet.

5. Approved Manufacturers:

a. Alflex.
b. Carol Cable, Co.
c. Electri-Flex, Co.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit in and under slab from point-to-point.

M. Do not cross conduits in slab.

N. Maintain adequate clearance between conduit and piping.

O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C). Install horizontal conduit runs above water and steam piping.

P. Cut conduit square using saw or pipecutter; de-burr cut ends.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

S. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

T. Install no more than equivalent of three 90-degree bends between boxes except for communication conduits, for which fewer bends are allowed. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size.

U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints. Arrange conduit to cross seismic, control and expansion joints at right angles to joint.

W. Provide suitable pull string in each empty conduit except sleeves and nipples.

X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Y. Utilize wrapped rigid steel elbows in all non-metal underground conduit runs for changes in direction or stub outs. Arrange stub-ups so curved portion of bends are not visible above the finished slab.

Z. Install conduit to preserve fire resistance rating of partitions and other elements.

AA. Route conduit through roof openings using suitable roof jacks.

BB. Complete raceway installation before starting conductor installation.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements. Seal penetrations with approved sealant.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under Division 7.

END OF SECTION 26 05 33

SECTION 26 05 43.A

UNDERGROUND CONDUIT SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Conduit.

B Duct Bank Accessories.

C. Manholes and Handholes.

D Concrete.

E. Hardware.

1.02 RELATED SECTIONS

A. Section 26 05 00 - Basic Electrical Requirements.

B. Section 26 05 33 - Conduit.

C. Section 26 05 43 - Excavation, Trenching and Backfill.

D. Section 26 05 26 - Grounding and Bonding.

E. Section 26 05 29 - Supporting Devices.

1.03 REFERENCES

A. ANSI/IEEE C2 - National Electrical Safety Code.

B. ANSI/NFPA 70 - National Electrical Code.

C. ASTM A123 - Specifications for Zinc Coatings on Iron and Steel.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

C. Product Data: Provide for conduit, duct bank accessories, fittings, handholes, manholes and manhole accessories.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Accurately record actual locations of exact routing of underground conduit.

C. Accurately record actual locations of each manhole.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit and manholes on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of underground conduit prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Underground conduit routing is shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown on Drawings in approximate locations unless dimensions are indicated. Locate as required to complete duct system.

1.10 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct-banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

PART 2 - PRODUCTS

2.01 RIGID METAL CONDUIT

A. Manufacturers:

1. Allied Tube & Conduit.
2. LTV Steel.
3. Western Tube & Conduit.

B. Rigid Steel Conduit: ANSI C80.1. Conduit shall bear UL Label and manufacturer's name.

C. Fittings: ANSI/NEMA FB 1; steel.

2.02 NON-METALLIC CONDUIT

A. Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work include, but not limited to the following:

1. Carlon.
2. Cantex.
3. PW Pipe.

B. Description: Schedule 40, 80 PVC or ABS Plastic Utility Duct as indicated on Drawings. Conduit shall bear UL Label and Manufacturer's name.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.03 PRECAST CONCRETE MANHOLES

A. Manufacturers: Subject to compliance with requirements, manufacturer's products that may be incorporated into the work include, but not limited to the following:

1. Utility Vault Co.
2. Christy Concrete Products.
3. Utility Concrete Products.

B. Material: Reinforced precast concrete.

C. Construction: Modular sections with tongue-and-groove joints.

D. Reinforcing: AASHTO Classification H-20.

E. Shape: As indicated.

F. Nominal Inside Dimensions: As indicated.

G. Frames and Covers: ASTM A48; Class 30B gray cast iron, 30 inch size, machine finished with flat bearing surfaces. Provide cover with appropriate marking.

H. Duct Entry Provisions: Single duct or window knockouts as necessary. Cast End Bell or Duct-Terminating fitting in wall for each Entering Duct.

I. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.

J. Cable Rack Inserts: Minimum load rating of 800 pounds (365 kg). Locate at two feet on center.

K. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches with fastener to match mounting channel.

L. Cable Supports: Porcelain clamps and saddles.

2.04 HANDHOLES

A. Manufacturers: Subject to compliance with requirements, Manufacturer's products that may be incorporated into the work include, but not limited to, the following:

1. Utility Vault Co.
2. Christy Concrete Products.
3. Utility Concrete Products.
4. Carson Industries.

B. Material: Concrete or Polymer Concrete.

C. Construction: Factory Fabricated, monolithically poured or molded walls and bottom unless open bottom enclosures are indicated.

D. Shape: As indicated on the Drawings.

E. Inside Dimensions: As indicated on the Drawings.

F. Frames and Covers:

1. Weatherproof, secured with flush tamper resistant locking devices.
2. Frame and cover shall have load rating consistent with handhole and as indicated on the Drawings.
3. Provide cover with appropriate marking.

2.05 CONCRETE

A. Concrete shall have minimum compressive strength of 2,500 PSI at 28 Days or as indicated on Drawings.

2.06 ACCESSORIES

A. Underground Warning Tape: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

B. Duct separators as required by duct configuration. Separators shall be factory fabricated rigid PVC interlocking spacers sized for type and size of conduit with which used.

2.07 HARDWARE

A. Underground Warning Tape: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

B. Cable rack stanchion and arms shall be galvanized steel or non-metallic, stanchions shall be pre-punched with minimum of 9 holes for arm attachment. Arms shall be sized to accommodate quantity of cables and shall securely attach to the stanchion.

C. Insulators shall be high-glazed, wet-process porcelain arranged for mounting on cable arms.

D. Each manhole shall have installed a 3/4" x 10'-0" copper clad steel ground rod driven into the earth with #4/0 copper ground conductor brought into the manhole.

E. Connect exposed metal parts within each manhole to the ground rod or ground conductor with minimum #4 stranded hard-drawn copper wire.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavation, base material installation, and compaction is completed.

3.02 PREPARATION

A. Prepare excavation in accordance with manhole manufacturer's instructions.

3.03 INSTALLATION

A. Install conduit systems in accordance with manufacturer's instructions. Support conduit on duct separators coordinated with duct size and spacing.

B. Install conduit systems to locate top of ductbank at depths as indicated on drawings.

C. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.

D. Cut duct square using saw or pipe cutter; de-burr cut ends.

E. Insert conduit to shoulder of fittings; fasten securely.

F. Join nonmetallic conduit using adhesive as recommended by manufacturer.

G. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

H. Install no more than equivalent of three 90-degree bends between pull points.

I. Provide suitable fittings to accommodate expansion and deflection where required.

J. Terminate conduit at manhole entries using end bell.

K. Stagger joints vertically in concrete encasement 6 inches minimum.

L. Use suitable separators and chairs installed not greater than 4 feet on centers.

M. Install rigid steel elbows for stub-ups at poles, equipment and at Building entrances through the floor.

N. Band conduits together before backfilling or placing concrete.

O. Securely anchor duct to prevent movement during concrete placement.

P. Place concrete providing minimum 3 inch concrete cover at bottom, top, and sides of duct.

Q. Provide suitable pull string in each empty duct except sleeves and nipples.

R. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

S. Backfill trenches under provisions of Section 26 05 00, 26 05 43 and Division 01:

1. Restore surface features at areas disturbed by excavation and re-establish original grades.

2. Replace any concrete or asphalt removed or damaged during installation.

T. Interface installation of underground warning tape with backfill. Install tape 12 inches above conduit system.

U. After completion of duct lines and backfill, Mandrel each duct utilizing standard flexible Mandrel not less than 12 inches long, having a diameter approximately 1/4 inch less than inside diameter of duct. Submit Mandrel results to Engineer for approval.

3.04 PRECAST MANHOLE INSTALLATION

A. Install and seal precast sections in accordance with manufacturer's instructions.

B. Install manholes plumb.

C. Use precast neck and shaft sections to bring manhole cover to finished elevation.

D. Attach cable racks to inserts after manhole installation is complete.

END OF SECTION 26 05 43.A

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.02 RELATED SECTIONS

A. Section 26 05 19 - Building Wire and Cable.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic.

1. White letters on black background for normal power.

2. White letters on red background for emergency or stand-by power.

B. Locations:

1. Each electrical distribution and control equipment enclosure.

2. All disconnecting means in electrical service and distribution equipment.

3. Communication cabinets.

C. Letter Size:

1. Use 1/8 inch letters for identifying individual equipment and loads.

2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Adhesive type with 3/16 inch black letters on clear background. Use only for identification of individual wall switches and receptacles, control device stations, etc.

2.02 WIRE MARKERS

A. Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

1. Panduit.
2. 3M Company.
3. Thomas & Betts.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on shop drawings.
3. Color Code: See Section 26 05 19.

2.03 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines. Provide detectable type if so indicated on drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches below finished grade.

END OF SECTION 26 05 53

SECTION 26 24 13

DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Main switchboard.

B. Distribution switchboard.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ANSI/IEEE C12.1 - Code for Electricity Metering.

C. ANSI C39.1 - Electrical Analog Indicating Instruments.

D. ANSI C57.13 - Instrument Transformers.

E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

F. NEMA KS 1 - Enclosed Switches.

G. NEMA PB 2 - Deadfront Distribution Switchboards.

H. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.03 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

C. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

D. Test Reports: Indicate results of factory production tests.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept switchboards on site. Inspect for damage. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

B. Do not deliver or install switchboards until spaces are enclosed and weathertight.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings. Coordinate layout and installation with other construction. Maintain required work space.

1.10 MAINTENANCE MATERIALS

A. Provide two of each key.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

A. General Electric.

B. Square D.

C. Siemens.

D. Eaton.

2.02 SWITCHBOARD

A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.

B. Bus Material: Copper, standard size.

C. Bus Connections: Bolted.

D. Ground Bus: Extend length of switchboard.

E. Fusible Switch Assemblies 600A & Smaller: NEMA KS 1, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses, type as specified.

F. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses.

G. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1, molded case circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

I. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, molded case circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole.

Interrupting rating 100,000 rms amperes symmetrical let-through current and energy level less than permitted for same size Class RK-5 fuse.

J. Solid-state Molded Case Circuit Breakers: NEMA AB 1, provide with electronic sensing, timing and tripping circuits for adjustable current settings. Provide ground fault sensing integral with circuit breaker as indicated on the drawings.

K. Ground Fault: Provide adjustable ground fault sensitivity and time delay. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

M. Provide fuses in accordance with Section 26 28 13 and as indicated on the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for switchboard installation.

3.02 PREPARATION

A. Provide 4" thick minimum concrete housekeeping pad for all floor mounted equipment.

3.03 INSTALLATION

A. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing:

1. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

2. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.

3. Check tightness of accessible bolted bus joints using calibrated torque wrench.

4. Physically test key interlock systems to insure proper function.

3.05 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated or as instructed by the Engineer.

3.06 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

B. Thoroughly clean inside of cabinets removing all debris and excess construction material.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Distribution panelboards.

B. Branch circuit panelboards.

1.02 RELATED WORK

A. Section 26 05 29 - Supporting Devices.

B. Section 26 05 53 - Electrical Identification: Engraved nameplates.

1.03 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

D. NEMA KS 1 - Enclosed Switches.

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 PROJECT RECORD DOCUMENTS

A. Record actual locations of Products; indicate actual branch circuit arrangement.

1.06 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

1.11 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

A. Square 'D'.

B. General Electric.

C. Siemens.

D. Eaton.

2.02 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, circuit breaker type equal to Square 'D' I-Line style fusible switch type equal to Square 'D' QMB style.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated ground bus where indicated.

C. Minimum short circuit rating: As indicated on Drawings.

D. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

E. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1. Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

G. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

H. Provide circuit breaker accessory trip units and auxiliary switches as indicated.

I. Enclosure: NEMA PB 1, Type 1 or Type 3R as indicated on Drawings.

J. Cabinet Front: Surface type, fastened with concealed trim clamps or hinge and latch. Finish in manufacturer's standard gray enamel.

2.03 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type.

B. Panelboard Bus: Copper ratings as indicated. Provide copper neutral bus and ground bus in each panelboard; provide insulated ground bus; Provide isolated, insulated ground bus where scheduled. Neutral and ground busses shall be solid drilled AL/CU rated with Allen Driven shoulderless set-screws. Stamped metal bars shall not be acceptable.

C. Minimum integrated short circuit rating: 10,000 minimum amperes rms symmetrical for 240 volt panelboards; 14,000 minimum amperes rms symmetrical for 480 volt panelboards. Refer to drawings for higher ratings required.

D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

E. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

F. Enclosure: NEMA PB 1, Type 1 or Type 3R.

G. Cabinet Front: Flush or Surface cabinet front as indicated with Door-in-Door style and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

H. Panelboards indicated to have an isolated ground bus shall be UL Listed for non-linear loads, have a larger cabinet box to maintain minimum wire bending space and box fill required by NFPA 70.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 26 05 29.

C. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 260553.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 3/4 inch. Identify each as SPARE.

3.02 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Device plates and decorative box covers.

E. Floor box service fittings.

F. Poke-through service fittings.

1.02 RELATED SECTIONS

A. Section 26 05 33 - Boxes.

B. Section 26 05 53 - Electrical Identification.

1.03 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

1.04 SUBMITTALS

A. Submit manufacturer's standard data for products furnished under this section in accordance with Section 26 05 00 and Division 01.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 WALL SWITCHES

A. Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

1. Leviton.

2. Hubbell.
3. Pass & Seymour.

B. Devices shall be 20A, 120-277 Volt, specification grade.

C. Color as selected by Architect.

2.02 WALL DIMMERS

A. Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

1. Leviton.
2. Hubbell.
3. Pass & Seymour.
4. Lutron.

B. Description: Semiconductor dimmer for incandescent and/or fluorescent lamps as indicated on Drawings.

C. Device Body: Color per Architect with linear slide.

D. Power Rating: Match load and voltage as shown on Drawings; 1000 Watts minimum unless indicated otherwise on Drawings.

E. Fluorescent Dimmer shall be compatible with fluorescent dimming ballasts.

2.03 RECEPTACLES

A. Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

1. Leviton.
2. Hubbell.
3. Pass & Seymour.

B. Devices shall be 20 Ampere, 125 Volt, specification grade unless noted otherwise on Drawings.

C. Color as selected by Architect.

2.04 WALL PLATES

A. Decorative Cover Plate: Color per Architect, smooth nylon:

1. Manufacturer to be same as device manufacturer.

B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.

C. Receptacle Cover Plate: Color per Architect, smooth nylon:

1. Manufacturer to be same as device manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify floor boxes are adjusted properly.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on bottom unless noted otherwise on Drawings.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping conductor around screw terminal.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33.B to obtain mounting heights indicated on Drawings.

3.05 FIELD QUALITY CONTROL

A. Operate each wall switch with circuit energized and verify proper operation.

B. Verify that each receptacle device is energized.

C. Test each receptacle device for proper polarity.

D. Test each GFCI receptacle device for proper operation.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED SECTIONS

A. Section 26 05 53 - Electrical Identification.

1.03 REFERENCES

A. NFPA 70 - National Electric Code.

B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

1.05 PROJECT RECORD DOCUMENTS

A. Record actual fuse sizes.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.08 MAINTENANCE MATERIALS

A. Provide two fuse pullers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Bussmann.

2.02 FUSE REQUIREMENTS

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Provide type as indicated on Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

1.02 RELATED SECTIONS

A. Section 26 05 53 - Electrical Identification

B. Section 26 08 13 - Fuses

1.03 REFERENCES

A. NEMA KS 1 - Enclosed Switches.

B. NFPA 70 - National Electrical Code.

C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.

D. UL 198E - Class R Fuses.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00 and Division 01.

B. Product Data: Provide switch ratings and enclosure dimensions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NECA Standard of Installation.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.08 EXTRA MATERIALS

A. Furnish under provisions of Division 01.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to, the following:

A. General Electric.

B. Square 'D'.

C. Siemens.

D. Eaton.

2.02 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

3. Other Locations: NEMA Type to match environment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate layout and installation with equipment served and adjacent surfaces. Maintain required work space clearances and required clearances for equipment access doors and panels.

B. Install disconnect switches where indicated.

C. Install fuses in fusible disconnect switches.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

E. Label per use, (Example "AC Unit #1").

END OF SECTION 26 28 16