PROJECT MANUAL
FOR THE

CITY OF TORRANCE
NEW EMERGENCY OPERATIONS CENTER

AT

3301 Airport Drive
Torrance, CA 90505

Prepared by:
AWu Government Services
2909 Oregon Ct, Ste C6
Torrance, California 90503

For OWNER:
City of Torrance
Torrance, California

April 14, 2021
April 21, 2023 (revised)

SECTION 000010
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CITY OF TORRANCE
TORRANCE EMERGENCY OPERATIONS CENTER

SPECIFICATIONS

END OF SECTION

SECTION 01 1000

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor – used in DDB must provide all material, labor, tools, plant, supplies, equipment, transportation, superintendence, temporary construction of every nature, and all other services and facilities necessary to complete the construction of a postal facility for the City of Torrance, including all incidental work described in the contract documents. For purposes of this construction project, the terms, “Owner”, “Offeror”, and “Contractor” are interchangeable and refer to the party whose proposal is accepted by the City.

B. The scope of work is attached to the Contract.

C. All work shall be in accordance with applicable codes and local regulations that may apply. In case of conflict in or between the Contract Documents and a governing code or ordinance, the more stringent standard shall apply.

1.2 MISCELLANEOUS CONTRACT EXPENSES

A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Permits and Responsibilities* and, *Building Codes, Fees and Charges*, the Contractor must include in its price proposal a separate line item for the cost each of the of the following fees or charges payable to State, local, or general services development agencies:

Water service connection and meter fee _____
Electrical company required fees _____
Telephone company required fees _____
Off-site inspection fees _____
Sanitary sewer connection fee _____
Environmental Permits/Registrations _____
Other permits or fees _____

B. If the actual cost of any item identified above is more or less than the amount listed, the contract price will be adjusted accordingly by a contract modification. The adjustment will not include overhead and profit. The Contractor must, within 30 days after incurring the expenses, inform the General Services Director or Designee that the payment has been made. Evidence of the actual amount paid must be provided. The contract amount will be adjusted upward or downward as necessary to accommodate actual charges from the utilities. The Contractor must provide all coordination with the utilities in accomplishing their work and must make all payments to the utilities for their work.

C. The Contractor must include all additional fees, as required, in the price proposal.

1.3 SOILS / GEOTECHNICAL REPORT – Attached behind this section.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

Western Laboratories
Geotechnical Engineering

GEOTECHNICAL EXPLORATION
PROPOSED EOC BUILDING
3301 AIRPORT DRIVE
TORRANCE, CALIFORNIA

MARCH 15, 2019

WORK ORDER 19-4709

PREPARED FOR:

CITY OF TORRANCE
3031 TORRANCE BOULEVARD
TORRANCE, CALIFORNIA 90503

2501 W. 237th Street, Suite B, Torrance, CA 90505 (310) 530-8900 — FAX (310) 530-8902

Western Laboratories

Geotechnical Engineering

March 15, 2019

Work Order 19-4709

Mr. Charlie Wilson
CITY OF TORRANCE
3031 Torrance Boulevard
Torrance, California 90503

Subject: Geotechnical Exploration Report
Proposed EOC Building
3301 Airport Drive
Torrance, California

Dear Sir:

Pursuant to your authorization to provide geotechnical engineering consulting services, the accompanying report has been prepared. This report was prepared in accordance with our proposal for geotechnical engineering services, dated February 1, 2019.

Based upon the subsurface conditions that were encountered during our exploration, it is our conclusion that the proposed development is considered feasible from a geotechnical engineering standpoint, provided the recommendations contained herein are incorporated into the planning, design and construction of the project. Conventional spread footing and isolated foundations shall be excavated into certified engineered fill soils(CEF) or very stiff to hard native soils for support of the proposed structures.

The contents in this report should be reviewed in detail and be made a portion of the design package. Please contact this office if any questions arise regarding the contents of this report.

Respectfully Submitted,

WESTERN LABORATORIES

George E. Hawes
Registered Civil Engineer
State of California C034779
Expires 9/30/19

REGISTERED PROFESSIONAL ENGINEER GEORGE E. HAWES No. C034779 STATE OF CALIFORNIA

This official stamp is in blue ink; otherwise a copy.

2501 W. 237th Street, Suite B, Torrance, CA 90505 (310) 530-8900 — FAX (310) 530-8902

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Introduction

This report presents the results of our geotechnical engineering exploration performed for the proposed EOC building to be constructed at the southwest side of the existing General Aviation Center, adjacent to the Western Museum of Flight, located at Zamperini Field, Torrance, California.

It is the understanding of WL that the proposed development will entail construction of an addition to the current Emergency Operation Center (EOC) facility along with associated improvements. It is anticipated that concrete pavement and landscape areas will surround the structure. No plans depicting the proposed development have been provided to WL at the time this report was prepared.

Purpose and Scope of Work

The purpose of our exploration was to evaluate the soil conditions at the site to provide geotechnical engineering recommendations for design and construction of the proposed development. Our work was based upon preliminary planning information and was conducted in accordance with generally accepted practice for the particular circumstance. The scope of our services included: subsurface exploration by drilling one exploratory boring, classification, laboratory testing, evaluation of the units encountered with respect to the proposed development, and analyzing the results of the field and laboratory work to provide the information contained in this report.

Site Description

The property is located on the southern side of the Torrance Airport, near the center of the property, just north of the intersection of Zamperini Way and Airport Drive. The proposed area is bordered on the North by asphaltic concrete pavement associated with the airport, on the East by the existing General Aviation Center, on the south by Airport Drive, and on the west by an existing hangar that houses the Western Museum of Flight.

The site topography is relatively level. Surface drainage appears to be accommodated by sheet flow.

Field Exploration

The subsurface conditions at the site were explored by drilling one (1) eight inch diameter hollow-stem auger exploratory boring at the location indicated on the attached plot plan, contained in Appendix A. The borings were logged by our field representatives Disturbed and undisturbed samples were obtained for laboratory testing and analysis.

Descriptions of the materials encountered in our exploratory boring are presented in Appendix A. The log only depicts subsurface conditions on the date shown on the logs at the approximate locations shown on the Plot Plan. Subsurface conditions may differ across the site from the conditions encountered in our borings.

Bulk and relatively undisturbed soil samples were obtained at depths appropriate to the exploration. The soil sampler utilized in our exploration included a 2-inch inside diameter drive barrel, lined with 1-inch brass rings. The central portions of the ring samples were retained for testing. All samples were immediately sealed in airtight containers and transported to the laboratory. Bulk, remolded, and relatively undisturbed soil samples serve as the basis for the laboratory testing and engineering conclusions contained in this report.

A brief description of the laboratory tests performed along with the test results are included in Appendix B, or shown on the logs.

Subsurface Conditions

Fill Soils were encountered in Boring 1 from existing grade to a depth of approximately six (6) feet below the surface. The alluvium immediately below the fill soils are comprised of stiff to hard and moist to wet, silty clay with rock fragments.

Fill soils encountered to a depth of approximately (6) feet below ground surface are comprised of soft to medium stiff and moist, silty clay with rock fragments.

Groundwater

Groundwater seepage was not encountered in our field exploration work to the maximum depths explored of approximately 26.5 feet. The historic high groundwater level within the vicinity of the site has been recorded at a depth of approximately ten (10) feet above sea level.

The above estimate was derived in part by using, Plate 1.2 of the "Seismic Hazard Zone Report 035 For The Torrance 7.5-Minute Quadrangle, Los Angeles County, California," 1998, with updates through 1/17/06, from the California Geologic Survey's (CGS) web site.

Fluctuation of the groundwater level at the site could occur due to variations in precipitation patterns, runoff, irrigation, basin management and other numerous factors.

Liquefaction Potential and Earthquake-Induced Landslides

This office has reviewed the Seismic Hazard Zones Official Map of the Torrance Quadrangle prepared by the State of California, Department of Conservation, Division of Mines and Geology (CDMG) Released: March 25, 1999. A copy of this map with a demarcation for the proposed site has been included in Appendix A.

The purpose of this map is to delineate areas that may be subject to liquefaction and/or landsliding during a strong seismic event. Based on this map, the property is not located within an area of study for liquefaction potential or earthquake-induced landsliding. The design of the proposed improvements in conformance with the 2016 California Building Code (CBC) provisions for earthquake design and is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

Lateral Spreading

Lateral spreading was not analyzed because there is no data to base an analysis, but our opinion is that geologically continuous layers prone to lateral sliding are unlikely that may affect the proposed improvement project, as for years there is no evidence of offsets and not a free face toward which lateral spreading may occur.

Seismic Design Factors

Lateral forces due to seismic loading may be calculated utilizing the formulas presented in the aforementioned CBC, based on the following:

Parameter		Design Value
Site Class	---	D
Mapped Spectral Acceleration at 0.2 sec Period	S_s	1.726
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.67
Short-Period Site Coefficient at 0.2 sec Period	F_a	1.0
Long-Period Site Coefficient at 1.0 sec Period	F_v	1.5
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.726
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.005
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.15
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.67

*Values Obtained from United States Geological Survey (USGS) Earthquake Hazards Program web site, https://seismicmaps.org/, based on the ASCE-7 and site coordinates Latitude 33.8013° and Longitude -118.3416°

It should be noted that conformance with the criteria listed above for seismic design does not constitute any kind of warranty or assurance that significant structural damage or permanent ground displacement will not occur if a maximum level seismic event occurs. The CBC provisions are generally intended to protect human life and catastrophic failure, and not to avoid all damage, since such design may be economically prohibitive.

Conclusions

The proposed EOC facility is considered feasible from a geotechnical engineering standpoint and will be safe against hazard from landsliding, settlement, and slippage. The proposed construction and grading operations will not have an adverse effect on the project site or adjacent properties, provided the work is performed according to the recommendations of this office.

Detailed recommendations to be utilized in the design and construction of the proposed development are presented in the following sections of this report.

Recommendations

The recommendations provided in this report are based upon observations made in the field, the results of laboratory tests on samples of the materials encountered during the subsurface exploration, and the past experience of this office.

Notification of Governing Authorities

Site grading operations should be performed in accordance with the local building and safety codes and the rules and regulations of those governmental agencies having jurisdiction over the subject construction. Grading operations should extend from property line to property, in accordance with the requirements of the City of Torrance.

A pre-grade meeting should be conducted with the owner's representative, the grading contractor, the grading inspector, and the Geotechnical Engineer's representative prior to initiating grading operations.

Following the on-site meeting, the grading contractor is responsible to notify the required governmental agencies and the Geotechnical Engineer prior to initiating grading operations, and any time grading is resumed after an interruption.

Site Grading and Compaction

Prior to commencing grading operations, any vegetation and soils containing organic matter should be stripped and hauled from the site.

Utility lines to be abandoned should be excavated, properly capped, and removed from the site.

The existing fill soils are not suitable in their present condition for slab or structural support. Foundations and slabs-on-grade should not transition from a condition where they are underlain by native soils to one where they are underlain by engineered fill soils (cut/fill transition). If this will occur, these units should be excavated to very stiff to hard alluvium within the proposed building areas, extending a minimum horizontal distance of five feet or the depth of fill soils, whichever is greater, outside of the proposed building areas where feesable. The removals should also extend to a depth that will accommodate a minimum of two (2) feet of compacted/engineered fill soils beneath the bottom of proposed building foundations.

The grading operation will be limited by property lines and existing improvements. Removal and re-compaction operations adjacent to property lines and structures should be performed with caution and may require the installation of temporary shoring or by performing slot-cuts in alternate (8-ft. wide maximum) A-B-C sections. All excavation bottoms shall be observed by Western Laboratories.

The exposed subgrade should be scarified to a minimum depth of 6 inches, be moisture-conditioned as required (typically 2 to 4 percentage points above optimum moisture), and be compacted to at least 90 percent of the maximum dry density of the materials as determined by the latest version of ASTM D1557 laboratory compaction test procedure.

The excavated soils may be used for re-compaction (engineered fill) provided they are free of root structures and deleterious debris, are moisture-conditioned as required (typically 2 to 4 percentage points above optimum moisture), spread in 8-inch thick loose lifts, and compacted to at least 90 percent relative compaction in accordance with the "General Specifications for Compacted Fill Soils."

Unstable subsurface conditions are sometimes encountered when grading operations are conducted when the ground is wet. If areas of unstable subgrade are encountered during grading operations, stabilization will be required prior to placement of fill soils, construction of slabs or foundations. Stabilization may entail adequately reducing the moisture of the exposed soils and placement of a stabilization layer that may be comprised of compacted base material or crushed angular rock, geotextile fabrics or geogrid, etc. Unit prices should be obtained from the contractor in advance for this work.

The Geotechnical Engineer or his representative may require that additional shallow excavations be made periodically in the exposed bottom to determine whether sufficient removal has been made prior to replacement and compaction of fill material.

If import fill is required, the fill should be approved by the Geotechnical Engineer prior to transporting it to the site. Import fill should be commensurate with the on-site soils. Representative samples of soils planned to be imported to the site should be provided to the Geotechnical Engineer at least 48 hours before importing begins in order that they may be examined and evaluated as to their potential impact on project design and construction.

Slope Construction

Any temporary excavation without shoring should be cut at a maximum slope of 1:1 (1 horizontal to 1 vertical), to a maximum height measured vertically of 10.0 feet. A visual inspection should be performed during the excavation by a representative of this firm. Temporary construction cut slopes are suitable for a short time duration, not to exceed (2) weeks.

In areas where a temporary 1:1 slope is not feasible, shoring designed by a Registered Professional Engineer knowledgeable and qualified in shoring design should be provided to support adjacent soils, structures, streets, and appurtenances, and to safeguard personnel.

Utility Trenches

Backfill of utilities within right-of-ways should be placed in strict conformance with the requirements of the governing agencies.

Following placement of utility lines within private property, the space under and around the line should be backfilled with clean sand or approved granular soil having a minimum sand equivalent of 30, to approximately one foot over the pipe. The sand bedding should be uniformly jetted into place before the remainder of the backfill is placed over the sand.

All backfills over the bedding material should be mechanically compacted to at least 90 percent of the maximum density obtainable by the latest version of ASTM D1557. Jetting or flooding of the backfill over the bedding should not be permitted.

Utility trench backfills should be observed and tested during backfill operations as the work progresses. If the testing of a backfill is performed after completion, without observing the backfill operations, then only the test results at the test locations can be given.

Foundations

Following completion of the grading operation and field density testing, the proposed structure should be supported on a continuous foundation system. The foundation trenches should be excavated to a minimum width of 15 inches and to a minimum depth of 24 inches below lowest adjacent grade into approved native or compacted/engineered fill soils. Continuous foundations having the preceding minimum dimensions should be designed utilizing an allowable bearing pressure of 1800 pounds per square foot (psf).

Due to the medium to high expansion potential of the tested on-site soils, any proposed pad footings should be a minimum of 24 inches square, and should be founded a minimum of 18 inches below proposed pad elevation. All pad foundations shall be tied to the continuous foundation system in at least two directions as determined by the Design Engineer for the project. Proposed pad foundations to be constructed in this manner should be designed utilizing an allowable bearing pressure of 2200 psf.

The proposed structure should be designed to accommodate a total foundation static and earthquake-induced settlement combined of approximately 1.25 inches, and differential static and seismic combined of 0.75 inch, over a horizontal distance of 30 feet. These estimates are based upon the foundations being designed and constructed in accordance with the recommendations contained in this report.

Resistance to lateral loadings may be provided by a combination of passive pressure on the footing walls and lateral sliding resistance acting on the base of the footings that are in contact with compacted/engineered fill soils. Passive earth pressure should be computed as an equivalent fluid unit weight of 240 pounds per cubic foot (pcf), to a maximum value of 2400 psf. A coefficient of friction of 0.48 may be applied to dead load forces for the sliding resistance calculation.

The allowable soil pressures may be increased one-third for combinations of vertical and horizontal wind or seismic forces where permitted by the latest edition of the CBC.

Excavations for proposed foundations should be stepped as necessary to produce level bottoms.

All foundations within the influence zone of underground lines or associated backfills, shall be deepened below a 1h:1v plane projected from the invert of the underground line or the native soil/backfill contact to ground surface. Also, the base of all wall footings to be constructed adjacent to footings at different levels, should be deepened such that the footing is below a 1h:1v projection upward from the bottom of the adjacent footing.

The following concrete footing reinforcement recommendations are minimums as based upon the medium expansion potential of the tested on-site soils. Continuous foundations should be reinforced with a minimum of four (4) #4 deformed reinforcing bars. Two (2) bars shall be placed near the bottom and two (2) bars near the top. Pad foundations should be reinforced as deemed necessary by the project Design Engineer.

Foundation excavations should be observed by a representative of this company prior to the placement of reinforcing steel to verify uniform soil conditions and conformance with the recommendations in this report.

Slabs-on-Grade

The concrete thickness and reinforcement recommendations provided below are minimums as based upon the medium to high expansion potential of the tested on-site soils. The Design Engineer for the project may need to address other factors which may require enhancement of these recommendations.

Building area concrete slabs-on-grade should be a minimum of 5 inches thick and be reinforced with a minimum of #4 Bars, placed 18 inches on center in both directions, and positioned in the center of the slab upon concrete dobies.

Slabs should be underlain with a capillary moisture break consisting of a minimum of 4 inches of clean sand and an impermeable membrane moisture vapor barrier (10 mil polyethylene or equivalent). The membrane should be encased within the sand layer to protect it during construction.

Due to the expansion potential of the soils encountered at the site, it is recommended that the upper 12 inches of the subgrade soils comprising the building pad should be confirmed to have a moisture content between 2 and 4 percent above the optimum moisture content of the material tested prior to the placement of the sand and visqueen section.

Care should be taken by the contractor to maintain the minimum recommended moisture content in the subgrade soils until the floor slab is constructed.

Shrinkage cracks in floor slabs during the cure process, is very common and is independent of the underlying soil characteristics. As concrete loses moisture, it shrinks in dimension. The occurrence of shrinkage cracks can be reduced and/or controlled by limiting the slump of the concrete, properly placing and curing concrete in accordance with the American Concrete Institute (ACI) recommended practices, and by placing crack control joints spaced at a maximum distance of 12.0 feet in each direction. The control joints should be cut to a depth equivalent to ¼ of the thickness of the slab. Reinforcement is intended to reduce, not stop cracking, and its proper positioning within the concrete section is critical to the overall performance of the slab.

Chemical Tests

It is recommended that chemical tests be performed on the soils that will be in contact with the proposed improvements to aid in the evaluation of soil corrosion potential and the attack on concrete by sulfates and soil corrosivity effects to metals. The tests should be performed when the recommended grading operation nears completion for the building pad and prior to foundation construction. In this way the material to be tested and the results obtained, will be based upon the as-graded soil conditions. Pending the results of the tests, Type V cement should be specified for concrete that will be in contact with the earth.
If any proposed subsurface utilities have metallic elements associated with them, it is recommended that the services of a qualified corrosion specialist be contracted by the owner of the property to evaluate soil corrosion potential at the site. No corrosion protection measures are required for buried utility lines comprised of vitrified clay, PVC, or other flexible plastic piping.

Site Surface Drainage

Control of site surface drainage of irrigation and storm water is critical for the long-term performance of the proposed EOC. Positive site drainage should be provided away from building foundations and flatwork to controlled drainage areas via non-erosive devices. Roofs should be provided with drainage devices that are connected to appropriate receptacles which discharge into engineered erosion-resistant areas. Proper drainage should be maintained at all times. The project civil engineers should make appropriate recommendations with regard to drainage and erosion control and assure that the requirements of Section 1804.3 of the 2016 CBC have been met.

Due to the medium to high expansion potential of the tested on-site soils, it is recommended that all planters adjacent to the structure and any flatwork areas, be properly sealed to prevent intrusion of moisture into these areas. Trees and large shrubbery should not be planted adjacent to the structure where roots could grow under its foundations and flatwork.

Structures constructed in expansive soil areas typically perform best when subgrade moisture conditions remain uniform. A properly designed, installed, adjusted and maintained automatic irrigation systems with drainage appropriately conducted away from the structure and flatwork areas can achieve this desired effect.

Closure

This report is prepared for the specific use of the City of Torrance for development of the proposed project described herein. Findings in this report are valid as of this date; however, changes in conditions of a property can occur due to the passage of time, whether they are due to natural processes or works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review after a period of one year.

Our services consist of professional opinions and conclusions developed by a consulting California Registered Civil Engineer. The warranty made by the consultant in connection with the services performed for this project is that such services are performed with the care and skill ordinarily exercised by members of the same profession practicing under similar conditions at the same time and in the same or a similar locality. No other guarantee or warranty, either expressed or implied, is made or attempted by rendition of consulting services or by furnishing written reports of the findings.

The information and recommendations contained in this report are based upon the assumption that the soil conditions do not deviate from those disclosed in our two exploratory borings. If any variations or undesirable conditions are encountered during the grading operation or construction, or if the proposed development will differ from that planned at the present time, WL should be notified so that supplemental recommendations can be provided, if warranted.

This report is issued with the understanding that it is the responsibility of the City of Torrance representatives, to ensure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plans and that the necessary steps are taken to see that the Contractors and Subcontractors carry out such recommendations during construction.

This report is subject to review by the controlling authorities for the project.

Our scope of work did not include evaluation of potential hazardous material contamination of soil or groundwater.

Supplemental Services

During the grading operation and construction, we should observe the conditions encountered in excavations and, if warranted, modify our recommendations.

We should observe excavations for proposed foundations prior to placement of forms or reinforcement. Our services during foundation construction are limited to observation of soil conditions and depth of the excavations.

Our services do not include observation or approval of steel, concrete, or asphalt; nor do they include establishing or verifying construction lines and grades. These services should be performed by the appropriate licensed parties.

Our supplemental services are performed on an as-requested basis, and WL cannot accept responsibility for items that we are not notified to observe or test. These supplemental services are in addition to this geotechnical engineering report, and will be billed for on a time and materials basis in accordance with our Professional Fee Schedule and our General and Commercial Terms & Conditions.

Maintenance

Periodic land maintenance will be required. Surface and subsurface drainage facilities must be checked frequently to assure that they are clean and working properly. Any damage to the drainage facilities must be repaired immediately.

Selected References

- American Society for Testing and Materials (ASTM) Volumes 04.08(I) & 4.09(II), Soil and Rock, 03/2015;
- ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures, 06/2013;
- Bowles, J.E., Foundation Analysis and Design, 4th Edition, McGraw Hill, 1988;
- California Building Standards Commission, 2016, California Building Code (CBC) California Code of Regulations Title 24, Part 2, Volume 2 of 2, effective date 01/2016;
- CDMG, Probabilistic Seismic Hazard Assessment, update 2008;
- CDMG Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps, Special Publication 42, Revised 1997, Supplements 1 and 2 added in 1999, Supplement 3 added in 2003;
- CGS, Guidelines for Evaluating and Mitigating Seismic Hazards in California , Special Publication 117A, 2008;
- Coduto, D.P., "Foundation Design: Principles and Practices." (2nd Edition) 2001, New Jersey: Prentice Hall;
- CGS, Seismic Hazard Zones Map, Torrance Quadrangle, Official Map dated 03/25/1999;
- CGS, Seismic Hazard Zone Report (035) for the Torrance 7.5-Minute Quadrangle, Los Angeles County, California, 1998, with revisions through 01/13/2006;
- T.W. Dibblee, 1999; Active Fault Source Data, U.S. Geological Survey Web Page, 2019;
- Ground Acceleration Data, U.S. Geological Survey Web Page, 2019;
  Map Showing Late Quaternary Faults of the Los Angeles Region, U.S. Geological Survey, 1989;
- USGS, Earthquake Hazards Program, Seismic Design Maps, http://siesmicmaps.org/;
- USGS, Map Showing Late Quaternary Faults of the Los Angeles Region, 1989;
- Client Provided Plan set By BOA Architecure for Torrance Municipal Airport, General Aviation Center. Dated: 4/23/92.
- WL unpublished in-house data.

General Specifications for Compacted Fill Soils

Preparation

The existing artificial fill should be removed under the observation of a representative of WL to expose competent subgrade to support the engineered fill. After approval from WL the exposed bottom, shall be scarified until it is uniform and free from large clods, moisture-conditioned where necessary and compacted, as specified in the body of this report, in accordance with the latest version of ASTM D1557.

Materials

On-site soils may be used for the engineered fill, or imported fill materials shall consist of materials approved by the Geotechnical Engineer, and may be obtained from the excavation of banks, borrow pits or any other approved source. The materials used should be free of organic matter and other deleterious substances and should not contain rocks or lumps greater than six (6) inches in maximum dimension.

Placing, Spreading and Compacting Fill Materials

A. The selected fill material should be placed in layers that when compacted shall not exceed six (6) inches in thickness. Each layer should be spread evenly and thoroughly mixed during the spreading to attain uniformity of material and moisture of each layer.

B. Where the moisture content of the fill material is below the limits specified by the Geotechnical Engineer, water should be added until the moisture content is satisfactory to attain thorough bonding and compaction.

C. Where the moisture content of the fill material is above satisfactory limits, the fill materials should be aerated, blended or dried until the moisture content is satisfactory.

D. After each layer has been placed, mixed and evenly spread, it should be compacted as specified in the body of this report. Compaction equipment should be selected by the contractor and be of such design that they will be able to compact the fill to the specified density.

Compaction should be accomplished while the moisture content of the fill material is within the compactable range. Compaction of each layer should be

accomplished by rolling the entire area with sufficient trips to attain the desired density. The final surface of areas to receive slabs-on-grade should be rolled to a dense, smooth, unyielding surface.

E. Field density tests should be performed by a representative of this company. Density tests should be performed at vertical intervals not to exceed two feet. When these readings indicate the density of any layer of fill is below the required density, the fill should be reworked until the required density has been obtained.

Observation

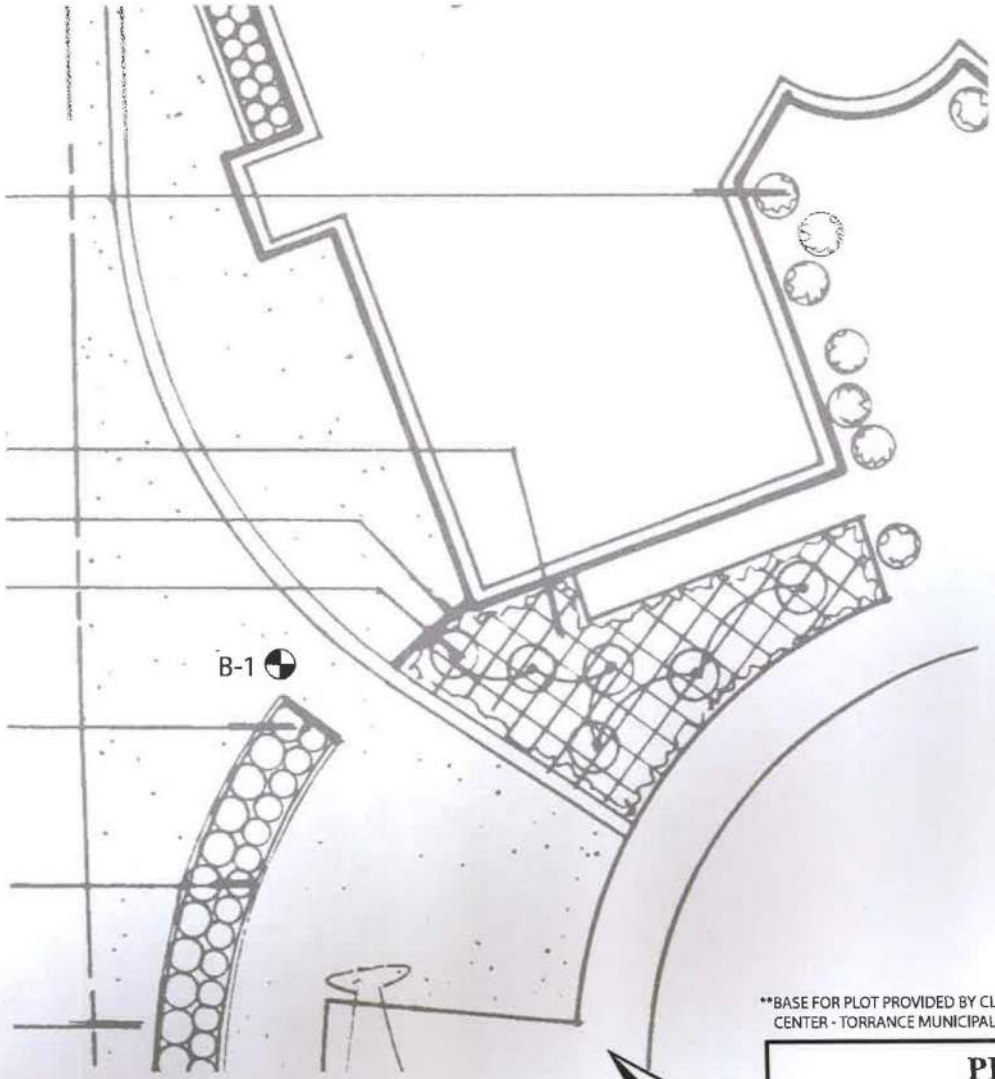
A representative of WL should observe all filling and compacting operations to verify that the fill is consistent and in compliance with the recommendations.

Seasonal Limitations

No fill materials should be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations should not be resumed until field tests performed by a representative of the Geotechnical Engineer indicate that the moisture content and density of the fill are as previously specified.

APPENDIX A

PLOT PLAN, BORING LOGS, AND SEISMIC HAZARD ZONE MAP



LEGEND:

BORING LOCATION

**BASE FOR PLOT PROVIDED BY CLIENT: L1 LANDSCAPE PLAN - GENERAL AVAIATION CENTER - TORRANCE MUNICIPAL AIRPORT, BY BOA ARCHITECTURE. DATED: 4/23/92

PLOT PLAN

SCALE:	N.T.S.	CITY OF TORRANCE	DRAWN BY:
DATE:	3-18-19		REVISED:

3301 AIRPORT DRIVE
TORRANCE, CALIFORNIA

WESTERN LABORATORIES	DRAWING NUMBER 19-4709

BORING 1

Sheet 1 of 2

Work Order: 19-4709
Date Drilled:2/22/19

Client: City of Torrance
Project: *Proposed E.O.C. Building*

Depth (ft)	Sample Type	Lab Tests	Blows/Foot*	DESCRIPTION 140 Lb. Hammer w/ 30" fall 8" Diameter Hollow-Stem Auger	Dry Unit Weight (pcf)	Moisture Content (%/Dry Wt.)	Notes
1	B R	EI	6	0.0-1.5 FILL-Silty CLAY (CL)-soft, moist, dark brn, w/ rock fragments and rootlets	96	30.1	EI=88
2				1.5-6.0 Silty CLAY (CL)-medium stiff, moist, dark brown, w/ brick & rock fragments			
3	R		10		84	34.8	
4							
5	R		11		88	32.7	
6							
7	R	DS	28	6.0-10.0 NATIVE-Silty CLAY (CL)-very stiff, moist, dark brown	98	29.3	
8							
9							
10	R		33		94	28.5	
11				10.0-25.0 Silty CLAY (CL)-very stiff, moist, w/ rock fragments			
12				Mottled @ 12'			
13							
14							
15	R		52	Hard @ 15'	91	30.1	
16							
17							
18							
19							
20	R		17	Stiff @ 20'	88	32.1	

BORING 1

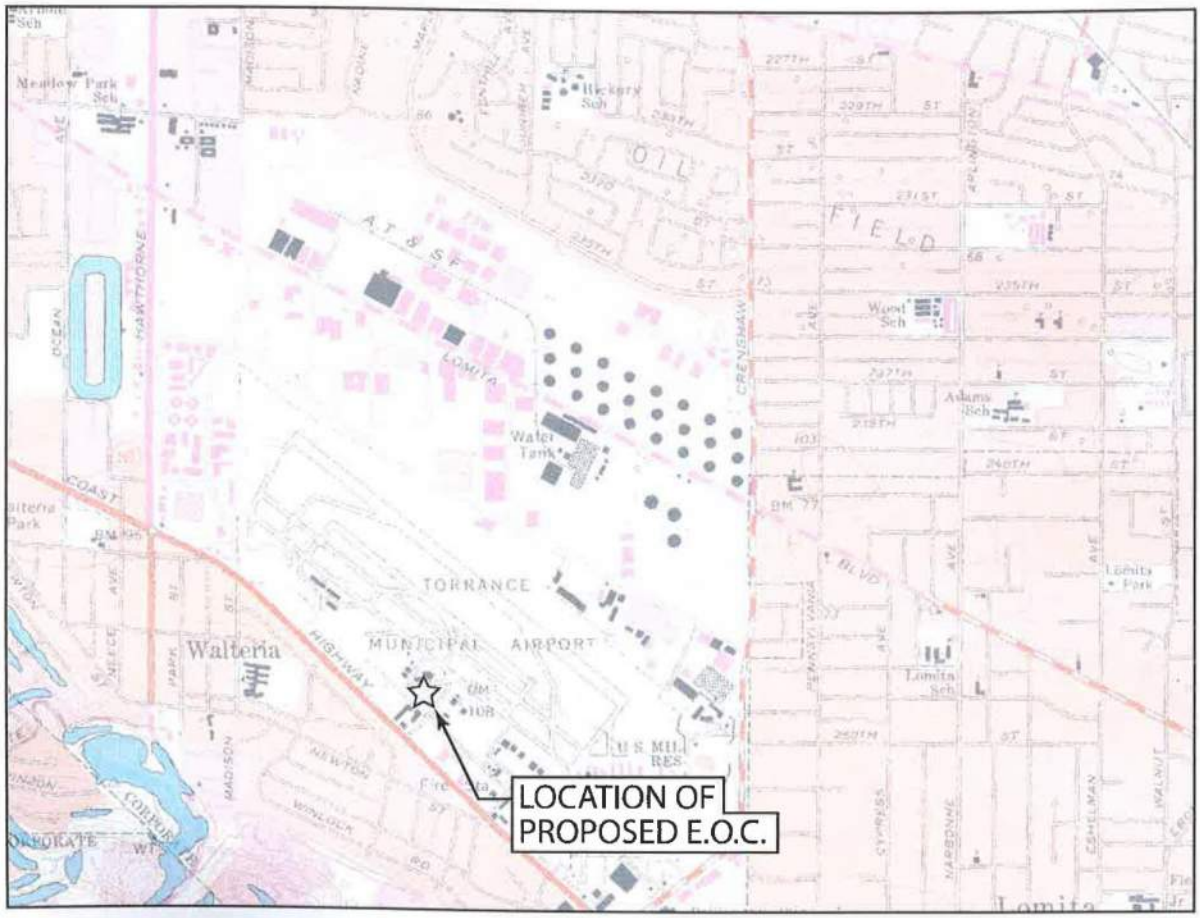
Sheet 2 of 2

Work Order: 19-4709
Date Drilled:2/22/19

Client: City of Torrance
Project: *Proposed E.O.C.*

Depth (ft)	Sample Type	Lab Tests	Blows/Foot*	DESCRIPTION 140 Lb. Hammer w/ 30" fall 8" Diameter Hollow-Stem Auger	Dry Unit Weight (pcf)	Moisture Content (%/Dry Wt.)	Notes
21				(cont.) Silty CLAY (CL)-very stiff, moist, w/ rock fragments			
25	R		44	Very Stiff @ 25'	101	27.3	
27				Boring terminated and backfilled Groundwater not encountered			

Western Laboratories
Geotechnical Engineering



SEISMIC HAZARD MAP			
SCALE: N.T.S.			DRAWN BY:
DATE: 3-7-19	CITY OF TORRANCE		REVISED:
3301 AIRPORT DRIVE TORRANCE, CALIFORNIA			
WESTERN LABORATORIES			DRAWING NUMBER 19-4709

APPENDIX B

LABORATORY TESTING

Laboratory Testing

The natural water content and dry density were determined on selected samples of the materials recovered from the borings. This information is recorded on the boring logs at the appropriate sample depths.

Direct Shear Tests (ASTM D 3080) were performed with a strain control type shear machine where the soil samples are subjected to a 0.002 inch per minute rate of strain, under varying loads and under conditions of saturation.

Expansion Index Tests were performed on representative samples of the near surface soils in accordance with UBC 29-2. In this test, soil is compacted into a metal ring to ±50 percent saturation. The sample is then placed in a device producing confining pressure of 144 psf (1 psi). The sample is then inundated with water and the amount of swell expressed as a ratio of the initial sample height times 1000 is recorded as the Expansion Index. The results of these tests indicate the soils to be medium to high in expansion potential, according to the preceding standard.

Direct Shear Test Report

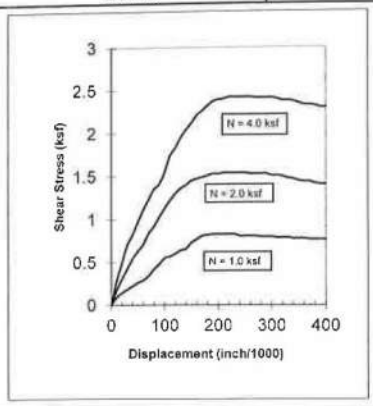
PROJECT: City of Torrance
Emergency Operation Center

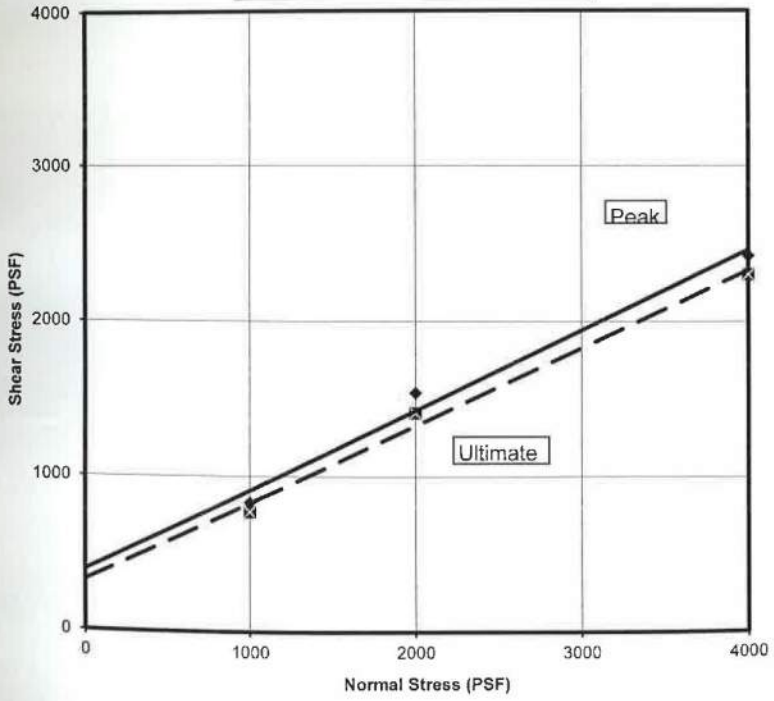
FIGURE N0.: DS-1
JOB No.: 19-4709
DATE: 03/06/19

Sample Identification	Sample Description	Sample Test State
B-1 @ 7'	Silty Clay	Saturated-Consolidated

Peak:	Phi (Degrees)	27.3	(Avg.Dry Dens. = 101.0 pcf)
	Cohesion (PSF)	620.0	(Avg.Moist. = 25.6 %)
Ultimate:	Phi (Degrees)	26.6	
	Cohesion (PSF)	530.0	

[X] Undisturbed
[ ] Remolded





Western Laboratories
Geotechnical Engineering

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

1.1 Scheduling Work

A. Before any of the work is started, the Contractor must confer with the General Services Director or Designee and agree on a sequence of procedures: means of access to premises and building; delivery of materials and use of approaches; use of corridors, stairways, elevators, and similar means of communication; and the location of partitions, eating spaces for Contractor's employees, and the like.

B. No work can be scheduled between the hours of 7:00am and 5:00pm without written permission from the General Services Director or Designee.

1.2 Pre-Construction Meeting

A. The General Services Director or Designee will schedule a pre-construction meeting before any work takes place. The Contractor's Project Manager, superintendent, and a representative of all major subcontractors shall attend this meeting. Additional persons may be required to attend the preconstruction meeting if directed by the General Services Director or Designee. At this time, the Contractor shall make pre-construction submissions including following:
   1. A typed list of the Contractors, Project Manager, Project Superintendent, and subcontractors (listed by trade) with a telephone number where they can be reached 24 hours/day, 7 days/week.
   2. Draft Schedule of Values.
   3. Draft Progress Schedule.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

1.1 Schedule of Submittals

A. Within 10 working days after receiving a Notice to Award, the Contractor must complete the Schedule of Submittals, in format indicated below, in duplicate, listing all items that must be furnished for review and approval by the City. The schedule must indicate the type of items (such as sample, shop drawings, catalog cut, and so forth) and include the scheduled dates of submittal. In preparing the schedule, adequate time (10 business days or more exclusive of time in the mails) must be allowed for review and approval and possible resubmittal. Also, the schedule must be coordinated with the approved construction progress chart. The Contractor must revise and/or update the schedule as directed. Such revised schedules must be received by the General Services Director or Designee within three (3) days after revision.

B. Schedule of Submittals Format

Project _____

Contract No. _____

Project Description _____

Spec. Section	Spec. Description	Paragraph Number	*Submittal Type	Date		Action Taken	Assigned Number
				Submittal	Returned		

*Submittal Type:

C – Certificate
S – Sample
SD – Shop Drawing
CD – Catalog Data
PL – Spare Parts List
MM – Maintenance Manual

1.2 Project Directory

A. At time of bid, together with bid documents, before work is performed on site, the Contractor must complete and submit to the General Services Director or Designee a listing of all subcontractors, including subcontractor name, address, telephone number, fax number and email address.

1.3 Shop Drawings and Related Data

A. Submittal of shop drawings, samples and related data must conform to the requirements of the project. Prior to submittal, the Contractor must stamp the submittal to indicate that it has been reviewed and approved.

B. 2 prints of all approved shop drawings must be given to the General Services Director or Designee. The approval of the drawings by the General Services Director or Designee must not be construed as a complete check but indicates only that the general method of construction and detailing is satisfactory.

Approval of the shop drawings does not relieve the Contractor of responsibility for any error that may exist because the Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all work. The submission by the Contractor must be accompanied by a transmittal letter of a type approved by the General Services Director or Designee.

1.4 Material, Equipment, and Fixture Lists

A. When required by the technical provisions, lists of materials, equipment, and fixtures must be submitted by the Contractor in accordance with the requirements specified for shop drawings. The lists must be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as by evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements. Catalog numbers alone are not acceptable. No consideration will be given to partial lists submitted from time to time. Approval of materials and equipment is tentative, subject to submission of complete shop drawings indicating compliance with the contract documents.

1.5 Certificates of Compliance

A. Any certificates required for demonstrating proof of compliance of materials with specification requirements, including mail certificates, statements of application, and extended guarantees, must be signed and submitted in quadruplicate to the General Services Director or Designee at least 10 days before delivery. The Contractor must review all certificates before submissions are made to the General Services Director or Designee, to ensure compliance with the contract specification requirements and to ensure that the affidavit is properly signed. Certification must not be construed as relieving the Contractor from furnishing satisfactory material if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

1.6 A-E's Review of Submittals

A. When submittals are reviewed by the A-E on behalf of the General Services Director or Designee, each submittal must be returned to the Contractor stamped or marked by the A-E in one of the following ways:
   1. NO EXCEPTIONS TAKEN: The Contractor is advised that means that fabrication, manufacture, or construction may proceed, provided the work complies with the contract documents.
   2. MAKE CORRECTIONS NOTED: The Contractor is advised that "B Action" means that fabrication, manufacture, or construction may proceed, provided the work complies with the A-E's notations and the contract documents.
   3. REJECTED: The Contractor is advised that means that no work may be fabricated, manufactured, or constructed and that the Contractor must make a new submittal to the A-E. Any submission marked “REJECTED” is not permitted on the site.

B. The A-E must return submittals to the Contractor, who is responsible for obtaining prints of them and for distributing them to the field and to subcontractors.

C. In the case of shop drawings in the form of manufacturers' descriptive literature, catalog cuts, and brochures stamped “NO EXCEPTIONS TAKEN” and “MAKE CORRECTIONS NOTED”, the A-E must return the stamped copies to the Contractor, who is responsible for distributing them to the field and to the subcontractors. If the shop drawings are stamped "REJECTED" the A-E will return stamped copies to the Contractor, who must submit new shop drawings to the A-E.

D. In the case of samples stamped " NO EXCEPTIONS TAKEN” and “MAKE CORRECTIONS NOTED”, the A-E must return one of the samples to the Contractor. In the case of samples stamped "REJECTED," the A-E must return all of the submitted samples.

END OF SECTION

SECTION 01 3543

ENVIRONMENTAL PROCEDURES

1.1 Scope

A. The work covered by this section consists of furnishing all labor, material, and equipment and performing all work required for compliance with environmental regulations and preventing pollution during, and as a result of, construction operations under this contract, in addition to those measures set forth in other technical provisions of these specifications.

B. The Contractor and subcontractors must comply with all applicable environmental federal, state, local environmental, health and safety laws and regulations.

1.2 Notification

A. The Contractor must, after receiving a notice of noncompliance with the foregoing provisions, immediately take corrective action. The notice, when delivered to its Contractor or its authorized representative at the site of the work, is deemed sufficient for this purpose. If the Contractor fails or refuses to comply promptly, the General Services Director or Designee may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost because of any such stop orders may be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is subsequently determined that the Contractor was in compliance.

1.3 Environmental Regulatory Compliance

A. Within 10 days after receiving the Notice to Proceed, or not less than 5 days prior to commencing on-site work, the Contractor must submit any environmental documents that are required by federal, state or local environmental regulations. Plans must be approved by the General Services Director or Designee prior to commencing on-site work and must describe and include, but is not limited to, the following:

1. Waste Minimization and Management Plan must describe how natural resources potentially impacted by construction will be protected or managed; construction wastes will be stored and disposed of or recycled; and pollutants associated with building materials will be controlled. The waste minimization and management section of the plan must also list materials and construction debris to be recycled, and address the disposal of solid and hazardous wastes and materials, including asbestos and lead-based paint.

1.4 Environmental Site Controls

A. Location of Hazardous Materials: The location of the Contractor’s temporary storage of any hazardous materials and/or wastes must be appropriately marked and included in the health and Safety Plan (see Section 1.5 below).

B. Post-construction Cleanup or Obliteration: The Contractor must remove and properly dispose of all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, excess or waste materials, or any other vestiges of construction as directed by the General Services Director or Designee. No separate or direct payment may be made for post-construction cleanup and all associated costs must be considered included in the contract price.

C. Historical and Archeological: Monuments, markers, and works of art must be protected. Items discovered that have potential historical or archeological interest must be preserved. The Contractor

must leave the archeological find undisturbed and must immediately report the find to the General Services Director or Designee so that the proper authority may be notified.

D. Dust Control: The Contractor must keep the site free from dust in accordance with applicable regulations.

E. Noise Minimization: The Contractor must perform demolition and construction operations to minimize noise including conducting work during less sensitive hours of the day in accordance with applicable noise control regulations.

1.5 Health and Safety

A. Prior to commencing on-site work, the Contractor must submit an Occupational Safety and Health Administration (OSHA) Emergency Action Plan (EAP) to the General Services Director or Designee to demonstrate compliance by the Contractor and subcontractors with applicable OSHA regulations. If the Contractor is not required by OSHA to develop a written EAP, i.e. if 10 or fewer are employed for the construction project or any other specific regulations identified by OSHA, then the Contractor shall submit to the General Services Director or Designee a signed letter stating the Contractor shall meet OSHA's EAP requirements in a verbal communication to all employees.

B. The City of TORRANCE has provided a *Safety and Health Guide for Contractors*, as Attachment A to this section. Prior to commencing on-site work, Contractor must read the *Safety and Health Guide for Contractors* and must sign the attached Certificate of Understanding acknowledging and accepting the requirements stated therein.

C. Copies of Material Safety Data Sheets (MSDSs) for any hazardous material(s), as defined by OSHA's Hazard Communications Standard, must be included whenever such materials arrive on-site. MSDSs must be kept together and maintained centrally on-site through to project completion. Provide a copy of each MSDS in the Operating and Maintenance Manual.

D. The use of asbestos containing materials, in excess of one percent as defined by US Environmental Protection Agency regulations, is prohibited in the construction of this project. Provide an executed copy of the “Certificate of Asbestos and Lead-Based Paint (New Work)” in the Operating and Maintenance Manual.

E. The use of lead-based paint is prohibited in the construction of this project.

F. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

G. The Contractor must meet with the General Services Director or Designee to review the Asbestos and Lead-Paint Inspection Report.

H. The Contractor must sign and submit to the General Services Director or Designee the attached “Certificate of Asbestos and Lead-Based Paint” for this project.

END OF SECTION

Safety and Health Guide for Contractors

Certificate of Understanding

This *Safety and Health Guide for Contractors* was developed by the City of TORRANCE to provide guidance for contractors hired to perform repair, alteration, renovation, demolition, equipment installation, and other work requiring access to City of TORRANCE-owned or -leased property.

Distribution

A copy of this Certificate of Understanding should be signed by the Contractor's representative at the postaward orientation conference or before the commencement of work. A copy of this guide should be readily accessible where the work is being performed. The General Services Director or Designee's representative (CER) should thoroughly brief the Contractor's representative on the Contract Safety and Health Requirements contained herein.

Contractor's Verification Statement

As a representative of _____ (Contractor's name), I have received the *Safety and Health Guide for Contractors* prepared by the City of TORRANCE. As the Contractor's representative, I understand and accept the requirements contained herein, and I have reviewed each of the required sections of the guide with the COR and/or the designated City of TORRANCE representative. I agree to review the contents of this guide with all subcontractors hired to perform work on City of TORRANCE property.

Contractor's Representative

Printed Name: _____ Contact Number: _____

Signature: _____ Date: _____

Designated City of TORRANCE Representative

Printed Name: _____ Contact Number: _____

Signature: _____ Date: _____

Safety Representative (If Required by COR)

Printed Name: _____ Contact Number: _____

Signature: _____ Date: _____

City of TORRANCE CO, COR, or Project Manager

Printed Name: _____ Contact Number: _____

Signature: _____ Date: _____

Maintain a copy of this signed form in the City of TORRANCE and Contractor's project files.

Safety and Health and Related Environmental Requirements

The Contractor is required to meet all applicable OSHA, federal, state, and local safety, health, and related environmental requirements in addition to the City of TORRANCE requirements listed in this table.

Issue	City Requirements
Asbestos	*Review of Facility Asbestos Survey:* Before any building maintenance, equipment installation, renovation, alteration, demolition, or other project begins, determine whether ACBM will be disturbed. Proper Work Practices: If ACBM is present, follow proper control procedures and work practices. *Consultation With Facility Asbestos Coordinator:* Consult with the facility manager or his or her designee before the start of any work likely to disturb ACBM. Disturbance means activities that crumble or pulverize ACBM or presumed asbestos-containing material (PACM) or generate visible debris. Operations may include drilling, abrading, cutting a hole, pulling cable, and crawling through tunnels or attics and spaces above the ceiling where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.
Barricades, Barriers, and Warnings	Your barricades must meet the OSHA requirements. In addition, you assume control of your work area during your activities unless otherwise specified in writing by the General Services Director or Designee (CE) or General Services Director or Designee's representative (CER).
Confined Spaces	Confined space work must meet the OSHA requirements. You must have a comprehensive confined space program that includes a written program, employee training, entry and testing equipment, and rescue capabilities. If you require access to confined space requiring a permit, then the trained, designated City of TORRANCE representative must review and approve the project and permit. Entry into other confined spaces must be in accordance with OSHA regulations.
Electrical Work	Lock or rope off work areas involving exposed energized equipment or have an attendant present to prevent accidental contact by unqualified people. Refer to the Barricade section of this guideline for additional information.
Elevated Work and Fall Protection	Follow strictly the applicable OSHA fall protection requirements.
Excavation	All excavations 4 feet or more in depth must be properly shored or sloped and meet all OSHA requirements. Before any digging or drilling commences, inform the General Services Director or Designee and call Dig Safe or its local equivalent to determine whether any underground utilities are located in the work area. Submit documentation that these notifications have been performed. You must not begin digging or drilling until you have verified that underground utilities have been identified and are properly marked so that work may be accomplished in a safe manner.
Fire Protection	Do not block, remove, or otherwise prevent City of TORRANCE fire extinguishers from being immediately accessible and usable. If a system must be impaired by a scheduled shutdown, notify the appropriate City of TORRANCE representative and do not proceed without City of TORRANCE authorization.
Hazard Communication	Inform the City of TORRANCE before any chemicals are used. Before materials are brought on site, provide material safety data sheets (MSDSs) and an inventory of materials. For projects that are anticipated to use substantial quantities of hazardous materials, you may be required to provide a routing, storage, and waste disposal plan. Upon request, the City of TORRANCE will make available to you MSDSs for hazardous materials the City of TORRANCE uses in the Contractor work area.
Hazardous Materials	Follow all OSHA requirements regarding hazardous materials. Hazardous materials include, but are not limited to, flammable and combustible liquids, gasoline, diesel fuel, motor oil, lubricating oil, hydraulic oil, corrosive cleaners, and battery acid. Provide secondary containment for all containers of liquids that are over 5 gallons in capacity. Immediately report all hazardous material releases ("spills"), regardless of how small or where they occur, to the designated City of TORRANCE representative. Releases include solids, liquids, and gases.
Hot Work	Do not begin any hot work until a City of TORRANCE qualified person has completed and signed a City of TORRANCE Hot Work Permit. The permit will be valid for only a single work shift. You must display the permit at the work site.

	You are prohibited from performing hot work (a) when the City of TORRANCE has not authorized it, (b) in locations in which fire protection systems have been impaired, (c) in the presence of explosive or flammable atmospheres, or (d) in locations were large quantities of flammable and combustible materials are unprotected.
Powered Industrial Trucks	Powered industrial trucks and other mobile equipment must follow all traffic rules of the City of TORRANCE facility. Perform refueling only in authorized locations following safe procedures.
Ladders	Strictly follow all OSHA requirements regarding ladders. Barricade the ladder use area to prevent contact with mobile equipment and employees.
Lead-Based Paint	*Review of Facility Lead Survey:* Before any construction, alterations, and/or repair activities begin, determine whether LBP will be disturbed. If the painted surface has not been tested, you must have it tested before beginning any activities that could potentially disturb LBP. *Proper Work Practices:* If LBP is present, follow proper control procedures and work practices. *Consultation With General Services Director or Designee:* Consult with the General Services Director or Designee or his or her designee before the start of any work likely to disturb LBP. Examples of activities that may affect LBP include paint removal by scraping, sanding, power tools, or heat guns; alterations that include removing drywall, structural steel, or other building materials coated with LBP; welding, cutting, or other hot work on coated metal surfaces; abrasive blasting of mail boxes and other equipment; and moving or cleaning of abrasive blasting enclosures.
Lockout/Tagout	Provide a copy of your lockout/tagout procedures, which must meet or exceed the OSHA Lockout/Tagout standard. You will be given access to and must review the City of TORRANCE lockout/tagout program. If you encounter a City of TORRANCE lockout/tagout device that prevents the continuation of work, do not make any attempts to remove, tamper with, or bypass the devices. Contact a City of TORRANCE Maintenance official and make arrangements to have the lockout device removed in accordance with City of TORRANCE lockout removal policies.
Personal Protective Equipment	Before beginning work, evaluate the work area for hazards, determine whether contract employees will be required to use personal protective equipment (PPE) to protect themselves from these hazards, and document the hazard assessment. Wear the PPE required by the City of TORRANCE facility in which you are working, regardless of your perception of hazard potential.
Regulated And Prohibited Materials	*Pesticides.* The City of TORRANCE has restricted the use of pesticides. Obtain prior approval of the district environmental compliance coordinator for special cases that may require the use of pesticide treatments. *Seventeen Chemical Prohibition.* Adhere to the City of TORRANCE Hazard Communication Program and chemical prohibition policies. Do not use on City of TORRANCE property any of the 17 chemicals prohibited by EPA unless a City of TORRANCE person authorizes its use (each of these chemical must be authorized separately). *Asbestos-Free Products.* Install no asbestos-containing products or materials in City of TORRANCE facilities. *Lead.* Apply no lead-based paint in City of TORRANCE facilities.
Scaffolding	Follow strictly the applicable OSHA scaffolding requirements. Provide adequate barrier protection around the scaffolding to prevent hazards to City of TORRANCE workers.
Walking and Working Surfaces	If the project requires temporary modifications to the means of egress, inform the designated City of TORRANCE representative before performing such actions, provide appropriate alternative means of egress, and communicated these to all employees.

Emergency Procedures

Preparations for Emergency	Be prepared for emergency situations. Ensure that emergency telephone numbers are site specific, readily available, easily read, and communicated to all employees. Train and authorize employees to implement emergency procedures.
Medical Emergencies	Have procedures and medical supplies to provide emergency medical services for your own personnel. Determine how to contact emergency medical services before work begins, and have on-site capabilities to contact such services immediately.
Fires	See Fire Protection above. In the event of a fire, you must: - Immediately remove personnel from the area or building following City of TORRANCE evacuation procedures. - Immediately contact the nearest City of TORRANCE employee and inform him or her of the fire. You may also activate an emergency alarm in the area. If no City of TORRANCE employees are on-site, immediately contact the local fire department. Personnel trained in the use and limitations of fire extinguishers may attempt to extinguish the fire if it is safe to do so.
Chemical Releases	See Hazardous Materials above. If the event of a hazardous material release, you must: - Immediately remove personnel from the area or building following City of TORRANCE evacuation procedures. - Immediately contact the designated City of TORRANCE representative and inform him or her of the release. You may also activate an emergency alarm in the area. If no City of TORRANCE employees are on-site, immediately contact the local fire department. Contractor personnel should not respond to the release unless specifically trained and protected to perform hazardous material response.
Power Outages	In the event of a power outage, you must: - Immediately stop work and assemble for a head count and possible facility egress. - Inform all contract employees that equipment may automatically restart when power resumes. - Immediately contact the designated City of TORRANCE representative and inform him or her of the status of contract work and personnel head count. Relay at this time all hazards created due to the power outage. When power resumes evaluate the status of operations that were being performed relative to hazard potential. For example, the interruption of ventilation in confined spaces may generate atmospheric hazards.
Accident Investigation and Reporting	As soon as is practical after an accident, investigate and document an accident investigation. The documentation must describe the incident and identify the causes and the corrective actions that will prevent future incidents. Report all accidents, whether or not they result in injury. Give the written report to the General Services Director or Designee within 24 hours of the accident or incident.

Certificate of Asbestos and Lead-Based Paint

(New Work)

To: General Services Director or Designee, City of Torrance

Subject: Certification for new construction

Facility name: _____

Facility address: _____

Certification for new construction:
This Contractor/Owner hereby certifies that no asbestos-containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and no lead-based paint has been furnished or installed at the referenced project.

Contractor/Owner name: _____

Signature: _____

Address: _____

_____

Telephone: _____ Date executed: _____

SECTION 014000

QUALITY REQUIREMENTS

PART 1 – GENERAL

1.1 CONTRACTOR QUALITY CONTROL

A. Contractor Quality Control: The Contractor is responsible for the overall quality of all its own work and the work performed by their subcontractors working under this contract. The quality of any part of the work installed must not be less than that required by the technical divisions of this specification. If the General Services Director or Designee determines that the quality of work does not conform to the applicable specifications and drawings, the Contractor will be advised in writing of the areas of nonconformance, and within 7 days the Contractor must correct the deficiencies and advise the General Services Director or Designee in writing of the corrective action taken.

B. Noncompliance with Quality Control Requirements: Failure of the Contractor to comply with the above requirements may be cause for termination for default as defined in the terms and conditions of the contract provisions and clauses, including those concerning, *Termination for Convenience or Default*, of the general contract clauses.

1.2 SUBMITTALS

A. Prior to the start of on-site work, the Contractor must submit to the General Services Director or Designee a Contractor Quality Control Plan that includes the following information:
   1. Quality Control Organization: In chart form, showing relationship of Quality Control organization to other elements of Contractor's organization.
   2. Names and qualifications of personnel in Quality Control organization, including Contractor Quality Control Representative, inspectors, Independent Testing and Inspection Laboratory, and Independent HVAC Test and Balance Agency.
   3. Procedures for reviewing coordination drawings, shop drawings, certificates, certifications, or other submittals.
   4. Testing and inspection schedule, keyed to Construction Schedule, indicating tests and inspections to be performed, names of persons responsible for inspection and testing for each segment of work including preparatory, initial, and follow-up.
   5. Proposed forms to be used including Contractor's Daily Report, Contractor Test and Inspection Report and Non-Compliance Check-Off List.

B. INDEPENDENT TESTING AND INSPECTION LABORATORY: Submit the following.
   1. Name.
   2. Address.
   3. Telephone number.
   4. Names of full time registered engineer.
   5. Responsible officer.
   6. Copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by inspection.

1.3 QUALITY CONTROL PROCEDURES

A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturers, products, services, site conditions, and workmanship.

B. Comply fully with manufacturer's published instructions, including each step in sequence of installation.

C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from General Services Director or Designee before proceeding.

D. Comply with specified standards as a minimum quality for work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.

F. Perform tests required by governing authorities having jurisdiction and utilities having jurisdiction.

1.4 TESTING AND INSPECTION LABORATORY SERVICES

A. Selection and Payment:
   1. The Contractor shall pay for services of an Independent Testing and Inspection Laboratory to perform specified testing and inspection.
   2. Employment of Independent Testing and Inspection Laboratory in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

B. Quality Assurance:
   1. Comply with requirements of all applicable ASTM standards.
   2. Laboratory: Authorized to operate in State in which Project is located.
   3. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
   4. Testing Equipment: Calibrated at reasonable intervals with devices of and accuracy traceable to either National Bureau of Standards or accepted values of natural physical constraints.

C. Laboratory Responsibilities. Contractor shall ensure the Laboratory has the following responsibilities and limits on authority:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at Project site. Cooperate with General Services Director or Designee and Contractor in performance of services.
   3. Perform specified sampling, testing, and inspection of Products in accordance with specified standards.
   4. Determine compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Contractor Quality Control Representative and General Services Director or Designee of observed irregularities or non-conformance of work or Products.
   6. Submit one copy of all test results directly to the General Services Director or Designee.
   7. Perform additional tests as required by General Services Director or Designee.
   8. Attend appropriate preconstruction meetings and progress meetings.

D. Limits on Authority. Contractor shall ensure the Laboratory has the following limits on authority:
   1. Laboratory may not release, revoke, alter, or expand on requirements of Contract Documents.
   2. Laboratory may not approve or accept any portion of work.
   3. Laboratory may not assume any duties of Contractors.
   4. Laboratory has no authority to stop work.

1.5 CONTRACTOR FIELD INSPECTION AND TESTING

A. Contractor: Test and Inspect work provided under this Contract to ensure work is in compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section.

B. Preparatory Inspection: Performed prior to beginning work and prior to beginning each segment of work and includes:
   1. Review of Contract requirements.
   2. Review of shop drawings and other submittal data after return and approval.
   3. Examination to assure materials and equipment conform to Contract requirements.
   4. Examination to assure required preliminary or preparatory work is complete.

C. Initial Inspection: Performed when representative portion of each segment of work is completed and includes:
   1. Performance of required tests.
   2. Quality of workmanship.
   3. Review for omissions or dimensional errors.
   4. Examination of products used, connections and supports.
   5. Approval or rejection of inspected segment of work.

D. Follow-Up Inspections: Performed daily, and more frequently as necessary, to assure non-complying work has been corrected.

E. Testing and Inspection: Perform testing and inspection in accordance with requirements in individual Specification Sections.

1.6 CONTRACTOR'S DAILY REPORT

A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Performance and Superintendence of Work by Contractor*, the Contractor shall submit daily report to General Services Director or Designee, for days that work was performed. Include the following information:
   1. Date, weather, minimum and maximum temperatures, rainfall, and other pertinent weather occurrences.
   2. Daily workforce of Contractor and subcontractors, by trades.
   3. Description of work started, ongoing work, and work completed by each subcontractor.
   4. Coordination implemented between various trades.
   5. Approval of substrates received from various trades.
   6. Nonconforming and unsatisfactory items to be corrected.
   7. Remarks, to include at a minimum, any potential delays, schedule changes, workplace incidents or other items of note. However, nothing reported herein shall relieve the Contractor of the separate responsibility under other terms and conditions of the Contract provisions and clauses to provide specific notice to the General Services Director or Designee,

1.7 CONTRACTOR'S TEST AND INSPECTION REPORTS

A. Prepare and submit, to General Services Director or Designee, a written report of each test or inspection signed by Contractor Quality Control Representative performing inspection within 2 days following day inspection was made.

B. Include the following on written reports of inspection:
   1. Cover sheet prominently identifying that inspection "CONFORMS" or "DOES NOT CONFORM" to Contract Documents.
   2. Date of inspection and date of report.
   3. Project name, location, solicitation number, and Contractor.
   4. Names and titles of individuals making inspection, if not Contractor's Project Field Superintendent.
   5. Description of Contract requirements for inspection by referencing Specification Section.

6. Description of inspection made, interpretation of inspection results, and notification of significant conditions at time of inspection.
7. Requirements for follow-up inspections.

1.8 NON-COMPLIANCE CHECK-OFF LIST

A. Maintain check-off list of work that does not comply with Contract Documents, stating specifically what non-complying, date faulty work is was originally discovered, and date work was corrected. No requirement to report deficiencies corrected same day it was discovered. Submit copy of Non-Compliance Check-Off List of non-complying work items to General Services Director or Designee on a weekly basis.

1.9 COMPLETION AND INSPECTION OF WORK

A. Prior to final acceptance by General Services Director or Designee, submit a certification signed by Contractor to General Services Director or Designee stating that all work has been inspected and all work, except as specifically noted, is complete and in compliance with Contract Documents.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 5000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities, construction facilities and temporary controls to be provided, maintained, relocated, and removed by CONTRACTOR.

B. Temporary office furnishings and office equipment.

C. Project signage.

1.02 QUALITY ASSURANCE

A. CONTRACTOR shall comply with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building Code requirements.

2. Health and safety regulations.

3. Utility company regulations.

4. Police, fire department and rescue squad requirements.

5. Environmental protection regulations.

B. CONTRACTOR shall arrange for the inspection and testing of each temporary utility prior to use. Obtain required certifications and permits and transmit to City.

C. CONTRACTOR provided facilities are to be in place and available for GENERAL SERVICES DIRECTOR OR DESIGNEE use and occupancy within (Insert Number of Days) calendar days following the date of issue of the Notice to Proceed and shall remain in place and available for GENERAL SERVICES DIRECTOR OR DESIGNEE use and occupancy throughout the full term of the Contract.

1.03 SUBMITTALS

A. Temporary Utilities: Submit to GENERAL SERVICES DIRECTOR OR DESIGNEE reports of tests, inspections, meter readings, certifications, permits and similar procedures performed on temporary utilities.

B. Project Signage / Banner: Submit to GENERAL SERVICES DIRECTOR OR DESIGNEE for review and approval.

1. Shop Drawings: Elevation showing the text, GENERAL SERVICES DIRECTOR OR DESIGNEE sign and color of project signage, jointing, fittings and location of grommets.

2. Certification: Submit certification attesting fabric is certified as flame retardant, in accordance to NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.04 PROJECT IDENTIFICATION SIGNAGE AND BANNERS

A. No other signs shall be displayed without approval of GENERAL SERVICES DIRECTOR OR DESIGNEE. At CONTRACTOR'S expense and without limitation remove and/or relocate Project signage and related facilities as rapidly as required in order to provide for progress of the Work.

1.05 TEMPORARY UTILITIES

A. CONTRACTOR shall coordinate with the appropriate utility company to install temporary services. Where the utility company provides only partial service, CONTRACTOR shall provide and install the remainder with matching compatible materials and equipment.

B. CONTRACTOR shall furnish, install and pay for all necessary permits, inspections, move ins/out, temporary lines, connections and fees, extensions and distribution, metering devices and use charges, deliveries/pickups, rentals, storage, transportation, taxes, labor, insurance, bonds, material, equipment and all other miscellaneous items for the temporary utility systems. The City shall pay to utility companies for the consumption of the following temporary utility services:

1. Temporary Water service.

2. Temporary Electrical service.

3. Temporary Gas service.

4. Temporary Telephone and Data.

C. Maintain, extend and/or relocate temporary utility systems as rapidly as required in order to provide for progress of the Work.

1. Water distribution piping and outlet devices shall be of the size and required flow rates in order to provide service to all areas of the Project site.

2. Furnish, install, maintain, extend and distribute temporary electric area distribution boxes, so located that individual trades can obtain adequate power and artificial lighting, at all points required for the Work, for inspection and for safety.

a. Provide 20 foot candles minimum lighting levels inside building(s) and 5 foot candles outside for safety and security.

b. Ensure welding equipment is supplied by electrical generators.

3. Provide temporary Heating, Ventilation and Air Conditioning. GENERAL SERVICES DIRECTOR OR DESIGNEE will not accept utilization of the permanent HVAC system for temporary HVAC until Substantial Completion. CONTRACTOR shall maintain manufacturer required levels of room and/or space temperature, humidity and ventilation necessary to install products,

materials and/or systems, cure materials, disperse humidity, remove fumes, and prevent accumulation of dust, irritants, or gases.

4. Provide temporary phone, data service and distribution to Project site temporary offices.

D. Upon Substantial Completion of the Work, remove temporary systems, devices and appurtenances.

1.06 TEMPORARY OFFICES

A. CONTRACTOR shall provide Project Site temporary office facilities for his own use for the duration of the Work. Construction trailer shall be accessible by GENERAL SERVICES DIRECTOR OR DESIGNEE and/or INSPECTOR on a 7 day a week 24-hour basis. CONTRACTOR shall provide the necessary materials and labor to provide the trailer with access for disabled persons on request by the GENERAL SERVICES DIRECTOR OR DESIGNEE. Trailer shall include, at a minimum, the following:

1. Conference room with a table and adequate seating for twelve.

2. One bathroom.

3. An open work area with devising partitions as required by GENERAL SERVICES DIRECTOR OR DESIGNEE.

4. Two enclosed, separate offices with windows and lockable doors.

B. Trailer shall be furnished with two exterior entrance doors with one located in a separate office. Each door shall be furnished with ‘Smart Key’ technology on both the dead bolt and cylinder lock. Provide six keys for each locking device. Exterior doors and windows shall be provided with exterior mounted burglar bars. Windows shall be provided with operable window shades. Security of trailer and contents is a continuous obligation of CONTRACTOR and shall be equipped with local sounding security system.

C. Trailer shall have ample headroom, 8-foot minimum, and shall be lighted, heated, ventilated, and air-conditioned. Provide an electrically chilled bottled water fountain of 5-gallon capacity. Purified water shall be supplied in 5-gallon containers, delivered weekly, with four spares on hand after each re-supply visit. As an option, CONTRACTOR may maintain a minimum of two 24 500ml bottles cases of purified water in General Services Director or Designee trailer throughout the duration of the project.

D. The separate offices shall each be approximately 120 square feet in size and shall be furnished with a minimum of four 120 volt single phase convenience outlets with one 4’ long multi-outlet power strip (such as Legrand Model #PM48C) at each outlet location as well as one telephone jack and one data/LAN outlet. The conference room shall be approximately 200 square feet in size and shall be furnished with a minimum of eight 120 Volt single phase convenience outlets with one telephone jack and one data/LAN outlet.

E. CONTRACTOR shall coordinate floor plan and location of electrical, telephone, data outlets with GENERAL SERVICES DIRECTOR OR DESIGNEE prior to ordering and delivering the trailer.

F. At CONTRACTOR'S expense and without limitation remove and/or relocate temporary office(s) and related facilities as rapidly as required in order to provide for progress of the Work.

G. Trailer shall remain property of CONTRACTOR. CONTRACTOR shall remove such property upon Substantial Completion of Work or as otherwise determined in writing by GENERAL SERVICES DIRECTOR OR DESIGNEE.

1.07 FURNISHINGS

A. CONTRACTOR shall provide furnishings in the following quantities, shall set in rooms and shall position as directed by GENERAL SERVICES DIRECTOR OR DESIGNEE upon delivery:

1. **2** rolling mid-back task chairs, with arms, provided new and shall remain as Contractor's property.

2. **10** padded folding meeting chairs, be provided new and shall remain as Contractor's property.

3. **2** desks, 30 by 66 by 30 inches: shall be provided new and shall remain as Contractor's property.

4. **2** metal bookcases, three shelf, 41 by 34 by 12 inches

5. **2** resin folding tables, 29 by 30 by 72 provided new and shall remain as Contractor's property.

6. **2** four drawer, legal size lateral filing cabinet. HON 500 series or equal. (Similar to Staples Item: 342892/Model: HON584L).

7. **2** four drawer, legal size lateral filing cabinet. HON 320 series or equal. (Similar to Staples Item: 904583/Model: HH324CPP).

8. **1** five (5) shelf storage/supply cabinet of approximately 78-inch high by 36-inch wide by 24-inch deep, furnished with locking doors, Sandusky or equal. (Similar to Staples Cat. # 880049/Model: SA4R362478-07).

9. Provide and install **2** large white board in one conference room, 48 by 72 inches, Quartet melamine dry-erase board or equal. (Similar to Staples Cat. # 789834/Model: S538).

10. Provide and install **2** large tack board in the other conference room, 48 by 72 inches, Quartet cork bulletin board or equal. (Similar to Staples Cat. # 789842/Model: QRT2308).

11. Provide and install **1** combination tack/white boards, 36 by 48 inches, one in each office, Quartet or equal. (Similar to Staples Cat. # 518886/Model: S554).

B. Unless otherwise noted in this Section, furniture shall remain property of CONTRACTOR. CONTRACTOR shall remove such property upon Substantial Completion of Work or as otherwise determined in writing by GENERAL SERVICES DIRECTOR OR DESIGNEE.

1.08 TELEPHONE & DATA AND TRANSMISSION LINES

A. Provide LAN and phone connectivity to all equipment specified below from the point of connection (POC) to equipment, including, but not limited to all cabling, jacks, patch panel, and patch cables as required to connect all of the equipment listed in this section to the LAN. Cabling shall be CAT 6 or better.

B. Provide **2** separate phone lines, one dedicated fax line and **2** phone instruments each with speakerphone, intercom, conference call, flash, redial, call hold and voice mail. Each phone instruments shall have a 4-line or more capacity/selectivity. Provide supporting terminal blocks and any required switch, router, power supplies, and amplifiers.

C. Provide business class Broadband data service. Broadband data service is defined as a minimum of 25 Mbps download.

D. Provide, install, and maintain the following specified equipment:

1. Cisco ISR 4331 capable of providing wireless Internet access. Smartnet will be provided for the entirety of the project to cover the networking equipment.

2. Cisco Small Business unmanaged switch with enough capacity to provide a wired Ethernet connection to each device in the office capable of using one.

E. Printer/Copier/Scanner/Fax: Provide, install, configure and maintain for network connectivity one HP LaserJet MFP M880z+ (or latest HP equivalent model at time of bid) with the following features and accessories:

1. B/W and Color.

2. Speed:

a. Copy: 46 ppm.

b. Scan: 70 ppm.

c. Print: 46 ppm.

3. Network capable.

4. Finisher with collation and one position stapling (minimum A2W80A HP LaserJet Stapler/Stacker).

5. Three paper trays integral with the equipment including 8 ½ by 11, 8 ½ by 14 and 11 by 17.

6. Additional 3500 sheet paper feed pedestal or drawer.

7. 2 GB Image Memory, 160 GB hard disk drive.

8. 600 by 600 dpi.

9. Zoom, Reduction and enlargement from 25 percent to 400 percent.

10. Embedded Print Controller with minimum 166 Mhz processor and 10/100 BaseT Network Interface Card.

11. 1Fax specifications: See standard for MFP model.

12. Maintenance: CONTRACTOR shall repair and service machine as necessary. Repair calls shall be responded to within 24 hours of placement.

13. Supplies: CONTRACTOR shall provide THE FOLLOWING:

    a. All toner supplies and consumables, including enough supplies to maintain two spares of each color toner.

    b. All staples and other printer-related consumables, including enough supplies to maintain one spare staple cartridge.

F. CONTRACTOR shall be responsible for maintaining all transmission lines, equipment and related devices. If equipment and/or transmission equipment becomes inoperable and downtime exceeds two days, CONTRACTOR shall replace and/or provide equivalent interim equipment.

G. CONTRACTOR shall employ an experienced and qualified MCSE certified Network Administrator, who shall be responsible to set up and service the LAN equipment and appurtenances provided in GENERAL SERVICES DIRECTOR OR DESIGNEE trailer, so as to maintain the equipment in continuous operation. Service response shall be within one day of incident.

H. Electronic/office equipment shall be new at the commencement of the project.

1.09 TEMPORARY STORAGE UNITS

A. CONTRACTOR shall provide secure and waterproof storage units for the temporary storage of furniture, equipment and other items requiring protection.

B. Walls, roof and doors shall be a minimum of 16-gauge steel with floors of 1 inch tongue and groove hardwood or ¾ inch minimum exterior type plywood. The undercarriage shall be designed to accommodate forklift blades 42-inch to 60-inch long. There shall be doublewide swing out lockable doors at one end equipped with waterproof gaskets.

C. CONTRACTOR shall be responsible for delivery charges and will install the storage unit in an appropriate area.

D. CONTRACTOR shall remove the storage unit from the Project site when the storage unit is no longer required for the Work or upon Substantial Completion of the Work.

E. CONTRACTOR shall at their expense and without limitation remove and/ or relocate storage units as rapidly as required in order to provide for progress of the Work.

1.10 TEMPORARY SANITARY FACILITIES

A. CONTRACTOR shall provide portable chemical toilet facilities. Quantity of portable chemical toilet facilities shall be based on total number of workers and shall be in accordance with CAL/OSHA standards.

B. Portable chemical toilet facilities shall be maintained with adequate supplies and in a clean and sanitary condition and shall be removed from the Project site upon Substantial Completion of the Work. CONTRACTOR shall keep chemical toilet facilities clean and operational at all times.

C. CONTRACTOR employees shall not use GAC toilet facilities.

D. At CONTRACTOR'S expense and without limitation remove and/or relocate portable chemical toilet facilities as rapidly as required in order to provide for progress of the Work.

E. CONTRACTOR will contain their breaks and lunch periods to the areas designated by GENERAL SERVICES DIRECTOR OR DESIGNEE or any public area outside the Project site. CONTRACTOR shall provide a suitable container within the break/lunch area for the placement of trash. Areas used for break/lunch must be maintained clean and orderly. Once finish flooring has been installed in a particular area, no food or beverages will be permitted in that area.

1.11 TEMPORARY SECURITY FENCE / BARRICADE

A. CONTRACTOR shall install temporary Project site security barricade(s) indicated on Drawings or as required for safety and as specified herein. New or used material may be furnished. Security of Project site and contents is a continuous obligation of CONTRACTOR.

B. Unless otherwise indicated or specified, security fence shall be constructed of 8-foot high chain link fencing with an 8-foot high windscreen. Space posts not to exceed ten feet on centers. Posts shall be of following nominal pipe dimensions: terminal, corner, and gatepost 2 ½-inch, line posts 2-inch. Chain link fence shall be not less than #13 gauge, 2-inch mesh, and in one width. Posts, fence and accessories shall be galvanized and as follows:

1. Shall be set in the earth a depth of 24-inch with soil firmly compacted around post, unless required otherwise in writing by GENERAL SERVICES DIRECTOR OR DESIGNEE.

2. Fence fabric shall be attached to posts with #14 gauge tie wire at 16 inches on center. A #6 gauge steel tension wire with turnbuckles shall be installed at top and bottom of barricade fencing. Wire tie fabric to tension wires at 18" centers.

3. Windscreen shall be attached to fence fabric and steel tension wires at 18-inch centers with a minimum of #14 gauge tie wire. Windscreen shall be maintained and all rips, tears, missing sections shall be corrected upon notification by GENERAL SERVICES DIRECTOR OR DESIGNEE.

4. Chain link fencing shall be free from barbs, icicles or other projections resulting from galvanizing process. Fence having such defects will be replaced even if it has been installed.

5. Gates shall be fabricated of steel pipe with welded corners, and bracing as required. Fence and fabric to be attached to frame at 12-inch centers. Provide all gate hardware of a strength and quality to perform satisfactorily until barricade is removed upon Substantial Completion of the Work. Each gate shall have a chain and padlock. Provide two gate keys to GENERAL SERVICES DIRECTOR

OR DESIGNEE. At Substantial Completion of the Work, remove barricade from Project site, backfill and compact fence footing holes. Existing surface paving that is cut into or removed shall be patched and sealed to match surrounding areas.

6. At CONTRACTOR'S expense and without limitation remove or relocate fencing, fabric and barricades or other security and protection facilities as rapidly as required in order to provide for progress of the Work.

1.12 OTHER TEMPORARY ENCLOSURES AND BARRICADES

A. Provide lockable, temporary weather-tight enclosures at openings in exterior walls to create acceptable working conditions, to allow for temporary heating and for security.

B. Provide protective barriers around trees, plants and other improvements designated to remain.

C. Temporary partitions shall be installed at all openings where additions connect to existing buildings, and where to protect areas, spaces, property, personnel, students and faculty and to separate and control dust, debris, noise, access, sight, fire areas, safety and security. Temporary partitions shall be as designated on the Drawings or as specified by ARCHITECT. At CONTRACTOR'S expense and without limitation remove and/or relocate enclosures, barriers and temporary partitions as rapidly as required in order to provide for progress of the Work.

D. Since the Work of this Project may be immediately adjacent to existing occupied structures and vehicular and pedestrian right of ways, CONTRACTOR shall, in his sole judgment and in accordance with applicable safety standards, provide temporary facilities, additional barricades, protection and care to protect existing structures, occupants, property, pedestrians and vehicular traffic. CONTRACTOR is responsible for any damage, which may occur to the property and occupants of the property of GENERAL SERVICES DIRECTOR OR DESIGNEE or adjacent private or public properties which in any way results from the acts or neglect of CONTRACTOR.

E. CONTRACTOR shall be responsible for cleaning up all areas adjacent to the construction site which have been affected by the construction; and for restoring them to at least their original condition- including landscaping; planting of trees, sod, and shrubs damaged by construction; and raking and disposal of debris such as roofing shingles, paper, nails, glass sheet metal, bricks, and waste concrete. Construction debris shall be removed and properly disposed of. Culverts and drainage ditches with sediment from the construction area shall be cleared routinely to maintain proper drainage and re-cleaned prior to completion of the contract.

F. CONTRACTOR shall ensure sediment does not block storm drains. CONTRACTOR shall be responsible for cleaning storm drains blocked due to erosion or sediment from the work area.

1.13 TEMPORARY STORAGE YARDS

A. CONTRACTOR shall fence and maintain storage yards in an orderly manner.

B. Provide storage units for materials that cannot be stored outside.

C. At CONTRACTOR'S expense and without limitation remove and/or relocate storage yards and units as rapidly as required in order to provide for progress of the Work.

1.14 TEMPORARY DE-WATERING FACILITIES AND DRAINAGE

A. For temporary drainage and de-watering facilities and operations not directly associated with construction activities included under individual sections, comply with de-watering requirements of applicable Division 01 sections. CONTRACTOR shall maintain the Work, Project site and related areas free of water.

B. For temporary drainage and de-watering facilities and operations directly associated with new buildings, additions or other construction activities, comply with Divisions 01 and 33 Sections. CONTRACTOR shall be responsible for, but not limited to, de-watering of excavations, trenches and below grade areas of buildings, structures, the Project site and related areas.

1.15 TEMPORARY PROTECTION FACILITIES INSTALLATION

A. CONTRACTOR shall not change over from using temporary facilities and controls to permanent facilities until Substantial Completion, except as permitted by GENERAL SERVICES DIRECTOR OR DESIGNEE.

B. Until permanent fire protection needs are supplied and approved by authorities having jurisdiction, CONTRACTOR shall provide, install and maintain temporary fire protection facilities of the types needed in order to adequately protect against fire loss. CONTRACTOR shall adequately supervise welding operations, combustion type temporary heating and similar sources of fire ignition.

C. CONTRACTOR shall provide, install and maintain substantial temporary enclosures of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security. Where materials, tools and equipment are stored within the Work area, CONTRACTOR shall provide secure lock up to protect against vandalism, theft and similar violations of security. GENERAL SERVICES DIRECTOR OR DESIGNEE accepts no financial responsibility for loss, damage, vandalism or theft.

D. CONTRACTOR operations shall not block, hinder, impede or otherwise inhibit the use of required exits and/or emergency exits to the public way, except as approved by GENERAL SERVICES DIRECTOR OR DESIGNEE. CONTACTOR shall maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for firefighting equipment and/or personnel.

E. With approval of GENERAL SERVICES DIRECTOR OR DESIGNEE and at the earliest feasible date in each area of the Work, complete installation of the permanent fire protection facilities including connected services and place into operation and use. Instruct GENERAL SERVICES DIRECTOR OR DESIGNEE personnel in use of permanent fire protection facilities.

F. In the event of an emergency drill or an actual emergency, designated by the sounding of the fire alarm and/or other sounding device, all construction activities must cease. CONTRACTOR shall evacuate the Work area and remain outside the Work area until permitted to return. No Work shall be conducted during the evacuation of a building or during an emergency.

1.16 TEMPORARY SECURITY AND SAFETY MEASURES

A. During performance of the Work in existing facilities and/or on a Project Site occupied by students, CONTRACTOR shall provide, install and maintain substantial temporary barriers and/or partitions separating all Work areas from areas occupied by students, faculty and/or administrative staff.

B. During performance of the Work in existing facilities or on a Project site occupied by public and where temporary barriers or partitions are not physically feasible, CONTRACTOR shall provide an employee to continually supervise and monitor all employees of CONTRACTOR and Subcontractor.

C. Penal Code Sections 290 and 290.4 commonly known as “Megan’s Law”, require, among other things, individuals convicted of sexually oriented crimes, to register with the chief of police where the convicted individual resides or with a county sheriff or other law enforcement officials. CONTRACTOR shall check its own employees and require each Subcontractor to check its employees and report to CONTRACTOR if any such employees are registered sex offenders. CONTRACTOR shall check monthly during the life of the Contract to ascertain this information and report same to GENERAL SERVICES DIRECTOR OR DESIGNEE. Before starting the Work, and monthly thereafter during the life of Contract, CONTRACTOR shall notify GENERAL SERVICES DIRECTOR OR DESIGNEE in writing if any of its employees and/or if any Subcontractor’s employees is a registered sex offender. If so, CONTRACTOR shall proceed in accordance with paragraph B above.

D. CONTRACTOR shall employ and maintain sufficient security and safety measures to effectively prevent vandalism, vagrancy, theft, arson, and all other such negative impacts to the Work. Any impacts to the progress of the Work of CONTRACTOR,GENERAL SERVICES DIRECTOR OR DESIGNEE, or GENERAL SERVICES DIRECTOR OR DESIGNEE’S forces, due to loss from inadequate security, will be the responsibility of CONTRACTOR.

E. Until Substantial Completion of the Work, CONTRACTOR shall employ appropriate means to remove all graffiti from buildings, equipment, fences and all other temporary and/or permanent improvements on the Project site within twenty-four (24) hours from the date of report or forty-eight (48) hours of each occurrence.

1.17 TEMPORARY ACCESS ROADS AND STAGING AREAS

A. Due to the limited amount of on and off Project site space for the parking of staff and public vehicles there will be no parking of CONTRACTOR vehicles in areas designated for public use only. CONTRACTOR shall provide legal access to and maintain CONTRACTOR designated areas for the legal parking, loading, off-loading and delivery of all vehicles associated with the Work. CONTRACTOR shall be solely responsible for providing and maintaining these requirements whether on or off the Project site. CONTRACTOR shall provide and maintain ample on-site parking spaces designated for the exclusive use of GENERAL SERVICES DIRECTOR OR DESIGNEE. CONTRACTOR shall erect signs as required by GENERAL SERVICES DIRECTOR OR DESIGNEE each of these spaces and prevent all unauthorized vehicles from parking in the GENERAL SERVICES DIRECTOR OR DESIGNEE-reserved spaces.

B. Temporary access roads are to be installed and maintained by CONTRACTOR to all areas of the Project site.

C. CONTRACTOR will be permitted to utilize existing facility roads as designated by GENERAL SERVICES DIRECTOR OR DESIGNEE. CONTRACTOR shall only utilize those entrances and exits as designated by GENERAL SERVICES DIRECTOR OR DESIGNEE and CONTRACTOR shall observe all traffic regulations of GENERAL SERVICES DIRECTOR OR DESIGNEE.

D. CONTRACTOR shall maintain roads and walkways in a clean condition including removal of debris and/or other deleterious material on a daily basis.

1.18 DIRECTIONAL SIGNAGE AND ADVERTISEMENT POSTING

A. CONTRACTOR shall provide and install signage to provide directional, identification, and contact information to construction personnel and visitors as follows and as reviewed by GENERAL SERVICES DIRECTOR OR DESIGNEE.

1. For construction traffic control/flow at entrances/exits, and as designated by GENERAL SERVICES DIRECTOR OR DESIGNEE.

2. To direct visitors.

3. For construction parking.

4. To direct deliveries.

5. For Warning Signs as required.

6. In accordance with CAL/OSHA standards as necessary.

7. For trailer identification and Project site address.

8. For “No Smoking” safe work site at designated locations.

9. Emergency contact information and phone number of CONTRACTOR.

10. Emergency contact information and phone number of local police, fire, and emergency personnel.

11. For Labor Compliance Program (LCP) as required under the General Conditions (Prevailing wage rates and Notice of LCP)

12. Employee benefits payments paid to trust funds are required under the General Conditions.

1.19 TRENCHES

A. Open trenches for installation of utility lines (water, gas, electrical and similar utilities) and open pits outside barricaded working areas shall be barricaded at all times in a legal manner determined by CONTRACTOR. Trenches shall be backfilled and patch-paved within twenty-four (24) hours after approval of installation by authorities having jurisdiction or shall have "trench plates" installed. Required access to buildings shall be provided and maintained. CONTRACTOR shall comply with all applicable statutes, codes and regulations regarding trenching and trenching operations. Open trenches deeper than 3'-

6", and not located within a public street access, shall be enclosed within an 8'-0" high chain-link fence.

1.20 DUST CONTROL

A. CONTRACTOR is responsible for dust control on and off the Project site. When Work operations produce dust the Project site and/or streets shall be sprinkled with water to minimize the generation of dust. CONTRACTOR shall clean all soils and debris from construction vehicles and cover both earth and debris loads prior to leaving the Project site. CONTRACTOR shall, on a daily basis, clean all streets and/or public improvements within the right of way of any and all debris, dirt, mud and/or other materials attributable to operations of CONTRACTOR.

1.21 WASH OUT

A. CONTRACTOR shall provide and maintain a minimum of four (4) wash out boxes of sufficient size and strength to provide for concrete mixer wash out. CONTRACTOR shall locate and relocate both the wash out boxes and wash out areas in order to accommodate the progression of the Work. The wash out area shall be located as to minimize the amount of potential run off onto adjacent private and/or public property. CONTRACTOR shall legally dispose of the contents of the wash out boxes and area on an as needed basis or as required by GENERAL SERVICES DIRECTOR OR DESIGNEE.

1.22 WASTE DISPOSAL

A. CONTRACTOR shall provide and maintain trash bins on the Project site. Trash bins shall be serviced on an as needed basis and CONTRACTOR is responsible for the transportation of and the legal disposal of all contents.

1.23 ADVERSE WEATHER CONDITIONS

A. Should warnings of adverse weather conditions such as heavy rain and/or high winds be forecasted, CONTRACTOR shall provide every practical precaution to prevent damage to the Work, Project site and adjacent property. CONTRACTOR precautions shall include, but not be limited to, enclosing all openings, removing and/or securing loose materials, tools, equipment and scaffolding.

B. CONTRACTOR shall provide and maintain drainage away from buildings and structures.

C. CONTRACTOR shall implement all required storm water mitigation measures as required under related Division 01 Sections.

1.24 DAILY AND MONTHLY REPORTS

A. CONTRACTOR shall provide and maintain in the Project site office of CONTRACTOR, a daily sign in sheet for use by all employees of CONTRACTOR and all Subcontractors at whatever tier. At the beginning of each work day, the foreman, project manager, superintendent of CONTRACTOR and/or Subcontractors shall visit the site office of CONTRACTOR and shall enter onto the daily sign in sheet: all employee names; trade classification; and represented company. The completed sign in sheet shall serve as the

basis of and shall be submitted with the daily construction report as set forth in Paragraph B below.

B. By the end of each workday, CONTRACTOR shall submit to GENERAL SERVICES DIRECTOR OR DESIGNEE, a daily construction report denoting the daily manpower counts and a brief description/location of the workday activities. Manpower shall be broken down by trade classification such as foreman, journeyman or apprentice. The report shall also note the date, day of the week, weather conditions, deliveries, equipment on the Project site whether active and/or idle, visitors, inspections, accidents and unusual events, meetings, stoppages, losses, delays, shortages, strikes, orders and requests of governing agencies, Construction Directive and/or Change Orders received and implemented, services disconnected and/or connected, equipment start up or tests and partial use and/or occupancies. CONTRACTOR shall also include on the daily construction report the above information for all Subcontractors at whatever tier.

C. CONTRACTOR shall submit on a monthly basis the forms found in Sections 01 3229 and 01 7416 certifying CEQA Mitigations and Storm Water Pollution Prevention (SWPP) compliances.

1.25 FIELD OFFICE SUPPLIES

A. CONTRACTOR shall provide the initial supply of field office supplies to GENERAL SERVICES DIRECTOR OR DESIGNEE in the quantities listed as set forth below in Table A.

B. CONTRACTOR may utilize different suppliers as the specified information is only to establish the required quantities and minimum levels of quality.

C. Replenishment of Field Office Supplies: Necessary as supplies are low.

D. Postage and Delivery Costs: CONTRACTOR shall provide postage and delivery services for generated materials in quantities and/or frequencies.

E. Other expendable field office support items specified elsewhere, including, but not limited to, furnishing toner cartridges, equipment maintenance, and bottled water, are to be supplied and paid for by CONTRACTOR.

Table A

ITEM	DESCRIPTION	UNIT	QUANTITY	SUPPLIER/ITEM NUMBER
Three Ring Binders – 3-inch	N/A	Each	**6**	Staples / 823526-54
Three Ring Binders – 2-inch	N/A	Each	**6**	Staples / 816199-54
Three Hole Punch	N/A	Each	**1**	Staples / 893844
Two Hole Punch	N/A	Each	**1**	Staples / 506261-54
File Organizer	N/A	Each	**1**	Staples / 120162-54
Calculator	Canon WS-1400H	Each	**2**	Staples / 342763
Flash Drive	2 GB	2	**1**	
Wastebasket	N/A	Each	**3**	Staples / 125039-54
Digital Camera	5 megapixel	Each	1	
Camera Flash Memory with reader for computer	5 GB	Each	1	
Camera Batteries and Rechargeable Batteries with charger	Appropriate to Camera	Each	1	

Cordless Phone with Answering Machine	AT&T Dect 6.0	Each	1	Staples / 1148831
Surge Suppressors	N/A	Each	**4**	Staples / IM1RA1696
Flashlight	N/A	Each	**2**	Staples / 222397
Batteries	N/A	4/Lot	**1**	Staples / 318956-54
Clipboard	N/A	3/Lot	**2**	Staples / 450422-54
8-inch Cast Iron Shears	N/A	Each	**1**	Staples / 421040-54
First Aid Kit	N/A	Each	**1**	Staples / 503979-54
Journal	N/A	Each	**1**	Staples / 217695-54
Pens (blue, green and red)	N/A	12/Lot	**1**	Staples / 441884-64
Pencils	N/A	48/Lot	**1**	Staples / 711382-54
Pencil Sharpener	1900	1	**1**	Staples / 330250-54
Mouse Pad	N/A	Each	**3**	Staples / 382955-64
Date Received Stamp	N/A	Each	**1**	Staples / 920274-54
Colored Pencils	N/A	12/Lot	**1**	Staples / 317297-54
Markers	N/A	12/Lot	**1**	Staples / 932675
Telephone Message Book	N/A	Each	**1**	Staples / 194506
Wall Calendar	PM233-28	Each	**1**	Staples / 527861-54
Steno Pad	N/A	12/Lot	**1**	Staples / 163485-64
Legal Pad	N/A	12/Lot	**1**	Staples / 163865-64
Post Its	N/A	12/Lot	**1**	Staples / 130005-64
File Folders – 8-1/2 by 11	N/A	50/Lot	**1**	Staples / 831099-54
File Folders – 8-1/2 by 14	N/A	50/Lot	**1**	Staples / 831057-54
Tape / Dispenser	N/A	Each	**1**	Staples / 211540-54
Highlighters	N/A	12/Lot	**1**	Staples / 167031
Rubber Bands	N/A	Each	**1**	Staples / 808634
Push Pins	N/A	Each	**1**	Staples / 480118-54
Dry Erase Board	S537	Each	**2**	Staples / 518928-54
Binder Clip – Medium	N/A	24/Lot	**4**	Staples / 831602-54
Binder Clip - Large	N/A	12/Lot	**2**	Staples / 831610-54
Stapler	818	Each	**3**	Staples / 504308
3 Pocket Wall File	N/A	Each	**2**	Staples / 730523-54
Heavy Duty Stapler	415	Each	1	Staples / 386312-54
Heavy Duty Staples	SW1-35312	Each	1	Staples / 504191-54
Hanging File Folder	8-1/2 x 11	25/Lot	**1**	Staples / 116806-54
Hanging File Folder	8-1/2x14	25/Lot	**1**	Staples / 163352-54
File Folder Labels	5266	750/Lot	**1**	Staples / 287292-54
Fax Notes	N/A	12/Lot	**1**	Staples / 210625-64
Paper Clips	N/A	Each	**6 boxes**	Staples / 480108-54
Paper Clips	N/A	Each	**6 boxes**	Staples / 480109-54
Poster Kit - State	CA	Each	1	Staples / 1183148
Poster Kit - Federal	US	Each	1	Staples / 935983-54
Broom	N/A	Each	1	Staples / 256600
Fire Extinguisher	First Alert	Each	**1**	Staples / 238774-54
Copy Paper	8-1/2 x 11	5000/Case	**10**	Staples / 122374-69
Copy Paper	8-1/2 x 14	500/Ream	**1**	Staples / 122598-69
Copy Paper	11 x 17	500/Ream	**1**	Staples / 238105-69
Hardhats	White	Each	**5**	Fiber Metal Model E-2 Ratchet knob full range size adjustment
Safety Glasses	Clear and/or Tinted	Each	**10**	Crews Storm Series
Safety Vests, Zipper Front	Hi Vis Lime Yellow	Each	**5**	Aramak Wearguard Item

				DEF-1085

PART 2 – PRODUCTS – Not Used

PART 3 – EXUTION – Not Used

END OF SECTION

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the terms and conditions of the contract provisions and clauses, including those concerning *Optional Materials or Methods (Construction)*, *Materials and Workmanship*, *Information On "Equal" Products* and *Brand Name or Equal.*

B. Provide Products that comply with Contract Documents, which are undamaged and new at time of installation.

C. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.

D. Substitutions may be considered when the Contractor:

1. Becomes aware of a product or procedure that is more environmentally sensitive or is otherwise advantageous to the City;
2. Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
3. Will provide the same guarantee for the substitution that he would for that specified; and
4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, at no additional cost to the City and at no extension of the Contract completion date.

1.2 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle Products in accordance with manufacturer's instructions, using means and methods that will prevent damage, deterioration and loss, including theft.

B. Schedule Product delivery to minimize long-term storage at Project site and prevent overcrowding of construction spaces.

C. Coordinate Product delivery with installation schedule to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

D. Deliver Products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

E. Promptly inspect shipments to ensure that Products comply with project requirements, quantities are correct, Products are undamaged, and properly protected.

F. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.3 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect Products in accordance with manufacturers' published instructions, with seals and labels intact and legible.

B. Store Products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's published instructions.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide off-site storage and protection when Project site does not permit on-site storage or protection.

E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Products.

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

G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 017300

EXECUTION

PART 1 – GENERAL

1.1 LAYOUT OF WORK

A. The Contractor must lay out its work from City-established base lines and benchmarks indicated on the drawings and is responsible for all measurements based on them. The Contractor must furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor as may be required in laying out any part of the work from the base lines and benchmarks established by the City. The Contractor is responsible for the execution of the work to those lines and grades established or indicated by the General Services Director or Designee.

1.2 CONTRACTOR'S TEMPORARY USE OF FACILITIES AND EQUIPMENT

A. No new facilities or equipment intended for the permanent installation, including materials-handling vehicles, may be used for temporary purposes unless specified in the Contract or unless the Contractor has the written permission of the General Services Director or Designee.

1.3 CLEANING

A. Refer to the terms and conditions of the contract provisions and clauses, including those clauses *Debris and Clean Up*.

B. Cleaning During Construction:
   1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
   2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
   3. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
   4. Collect and remove waste materials, debris, and rubbish from site as specified in the Environmental Compliance and Management Plan as required in Section 013543 - Environmental Procedures.

C. Final Cleaning:
   1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
   2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
   3. Complete following cleaning operations before requesting General Services Director or Designee inspection for Substantial Completion.
      a. Clean Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
      b. Remove tools, construction equipment, machinery and surplus material from Project Site.

c. 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.
d. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
e. Broom clean concrete floors in unoccupied spaces.
f. Provide final cleaning, waxing, and buffing of resilient tile, in accordance with manufacturer's requirements.
g. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.
h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
i. Remove labels that are not permanent labels.
j. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
k. Wipe surfaces of mechanical and electrical equipment, and other similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
n. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.
o. Leave Project clean and ready for occupancy.

4. Engage an experienced licensed exterminator to make a final inspection, and rid Project of rodents, insects, and other pests. Comply with regulations of local authorities having jurisdiction.
5. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.
6. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.
7. Where extra materials of value remain after completion of construction, they become City property and these materials should be stored as directed by General Services Director or Designee.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 017704

CLOSEOUT PROCEDURES AND TRAINING

PART 1 – GENERAL

1.1 MANUALS

A. Purpose: Operation and maintenance manuals are for the training of, and use by, City of Torrance employees in the operation and maintenance of the systems and related equipment as specified below. The manuals must consist of instruction on systems and equipment. A separate manual or chapter must be prepared for each of the following classes of equipment or system:
1. Landscaping.
2. Roof system.
3. Doors.
4. Security system.
5. Fire protection.
6. Plumbing systems.
7. Mechanical systems.
8. Electrical systems.
9. Miscellaneous building equipment and systems.
10. Mechanization (for requirements for mechanization maintenance manuals, see Mechanization Specification M-5000).

B. Content: Unless otherwise indicated, each chapter must contain the following, as applicable:
Introduction.
Table of contents.
Description of system (including design intent and considerations).

C. Preparation: The outline below is intended as a general guide for preparing the manuals. The manuals must be prepared to provide for the optimum operation and maintenance of the various systems. The description of systems and general operating instructions for plumbing and electrical manuals may cover only complicated or unusual parts of these systems, such as sewage ejectors, transformers, high tension switchgear, and signal and alarm systems. Manufacturer's literature and data must be those of the actual equipment installed under contract for the particular facility. Further guidance is available in the ASHRAE Handbook, 1984, Systems Volume, Chapter 39, Mechanical Maintenance.

D. Suggested Outline for Operation and Maintenance (O&M) Manuals: This is a suggested outline, with general requirements of O&M manuals. The outline is presented to indicate the extent of material to be covered and the individual items required in manuals for Mail Processing Facilities. The outline may be modified to suit specific installations; however, the purpose of the manual must be fulfilled. The manual is not intended to duplicate manufacturers' data, but proper references must be made in the text of the O&M manual to indicate that that information is applicable and where it is located.
1. Part I. Description and Design Intent
    a. Introduction
        1) Provide a brief description of the project and purpose of the maintenance manual. The following statements must be included: "Operation and maintenance of this equipment must be performed in accordance with this manual and posted instructions, subject to compliance with applicable technical guides and standards issued by the City. It is recognized that minor changes in control points and settings will be required, based on actual operating experience, to correct varying conditions and improve operation. When such changes appear necessary, they must be submitted to the maintenance manager for

consideration. Upon approval of any changes, the applicable portions of all copies of the manual and proposed instructions must be revised and reissued, and any change in operating procedure brought to the attention of all operating personnel."

2) "This manual is specifically developed to assist the City official in charge at the facility to operate and maintain the building systems and equipment. Manufacturers' recommendations set forth for certain components must be followed during the complete warranty period for that equipment."

3) Contents of Manual. This portion of the introduction must explain that the manual is to contain complete operating, maintenance, and safety instructions for all equipment listed. It must also contain any other appropriate references as required to outline an explanation of the manuals and major categories of reference material required with the manuals.

b. Table of Contents

1) The table of contents must list numbers and titles of chapters, sections, and main paragraphs, with their page numbers. Each volume in a set of manuals must contain its own table of contents. Publications containing 10 or more illustrations or tables must include a list of illustrations or tables, as applicable. These lists must show number, title, and page number of each illustration and table. Following is a typical table of contents:

a. Landscaping
   1.) Irrigation system
   2.) Lawns and grasses
   3.) Exterior plants
   4.) Plant maintenance

b. Roof System
   1.) Roof and flashing type
   2.) Local inspection (frequency and what is included)
   3.) Maintenance (when manufacturer performs, if the City performs what methods compatible materials, etc.)

c. Doors
   1.) Overhead coiling doors
   2.) Folding closures
   3.) Sectional overhead doors
   4.) Impact traffic doors
   5.) Automatic entrance doors
   6.) Specialized hardware

d. Security Systems
   1.) CCTV system
   2.) Intrusion detection
   3.) Electronic article surveillance
   4.) Access control

e. Fire Protection System
   1.) Water supply and distribution
   2.) Exterior fire hydrants
   3.) Sprinklers
   4.) Fire Department connections
   5.) Fire extinguishers
   6.) Exit signs

f. Plumbing Systems
   1.) Potable water
   2.) Domestic hot water
   3.) Roof and sanitary drains

g. Mechanical Systems

1.) Space conditioning
2.) Heating
3.) Central chilled water and distribution
4.) HVAC instrumentation and controls

h. Electrical Systems
1.) Incoming Service
2.) Electrical power distribution
3.) Lighting and lighting controls
4.) Fire alarm
5.) Emergency lighting unit

i. Miscellaneous Building Equipment
1.) Floor mats
2.) Window Treatments

2. Part II. Operating Sequence and Procedures

a. Contents: Each chapter must describe the procedures necessary for City of Torrance personnel to operate the system and equipment covered in that chapter.

b. Operating Procedures: The operating procedures must be divided into four subsections: Startup, Operation, Emergency Operation, and Shutdown.

1) Startup: Give complete instructions for energizing the equipment and making initial settings and adjustments whenever applicable. If equipment is fully automatic, a statement to that effect is all that is required. If a specific sequence of steps must be performed, give step-by-step instructions in the proper sequence. If timing- (such as warm-up between power-on and adjustment) is important, clearly state the specific minimum time required at the proper point in the procedure. Refer to controls and indicators by panel; make references consistent with the nomenclature used in illustrations and tables of controls and indicators. If preliminary settings differ for different modes of operations, give procedures for each mode.

2) Operation: Give detailed instructions in proper sequence for each mode of operation. When, for a given action on the part of the operator, alternate equipment responses are possible, give the appropriate operation reaction to each.

3) Emergency Operation: If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions. Include here only those alternate methods of operation (from normal) that the operator can follow when there is a partial failure or malfunctioning of components, or other unusual condition.

4) Shutdown: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

3. Part III. Maintenance Instructions and Requirements

a. Contents: Each chapter must describe the procedures necessary for City of Torrance personnel to perform the maintenance on the systems and equipment covered in that chapter. Emphasis must be placed on the method of mechanical control of systems and equipment from a maintenance standpoint. References must be made, as appropriate, to drawings, schematics, and sequences of operation included as part of the construction Contract drawings and specifications that show piping and equipment arrangements and items of control. Prints of these drawings must be reduced to 11 inches x 17 inches for insertion in the manuals. Drawings must represent the "as-built" condition.

b. Maintenance Procedures: The maintenance procedures must be divided into two categories: Preventive Maintenance and Corrective Maintenance.

1. Preventive Maintenance

a. Provide a schedule for preventive maintenance. State, preferably in tabular form, the recommended frequency of performance for each preventive maintenance task (cleaning, inspection, and scheduled overhauls).
b. Provide instruction and schedules for all routine maintenance cleaning and inspection, with recommended lubricants.
c. If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria for, but not limited to, the following:
1.) Motors
2.) Controls
3.) Filters
4.) Heat exchangers

2. Provide instruction for minor repairs or adjustments required for preventive maintenance routines. Minor repair and adjustment must be limited to repairs and adjustments that may be performed without special tools or test equipment and that require no special training or skills. Identify test points and give values for each.

c. Corrective Maintenance

1. Corrective Maintenance: Corrective maintenance instructions must be predicated upon a logical effect-to-cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime. Instructions and data must appear in the normal sequence of corrective maintenance, for example, troubleshooting first, repair and replacement of parts second, and then the parts list.
2. Troubleshooting: This information must describe the general procedure for locating malfunctions and must give, in detail, any specific remedial procedures or techniques. The data shown are intended to isolate only the most common equipment deficiencies. Troubleshooting tables, charts, or diagrams may be used to present specific procedures. A guide to this type must be a three-column chart. The columns must be entitled Malfunction, Probable Cause, and Recommended Action. The information must be alphabetically arranged by component, and each component must, in turn, list deficiencies that may be expected. Each deficiency must contain one or more problems with a recommended correction.
3. Repair and Replacement: Indicate the repair and replacement procedures most likely to be required in the maintenance of the equipment. Information included here must consist of step-by-step instructions for repair and replacement of defective items. Include all information required to accomplish repair or replacement, including information such as torque values. Identify all tools, special equipment, and materials that may be required. Identify uses for maintenance equipment. The paragraphs must contain headings to identify the topics covered.
4. Safety Precautions: This subsection must comprise a listing of safety precautions and instructions to be followed before, during, and after repairs or adjustments are made or routine maintenance is performed.

d. Manufacturers' Brochures: Include manufacturers' descriptive literature covering devices used in the system, together with illustrations, exploded views, and renewal parts lists. This section must also include special devices manufactured by the Contractor.

e. Special Maintenance: Provide information of a maintenance nature covering warranty items that have not been discussed elsewhere.

f. Shop Drawings: Provide a copy of all approved shop drawings covering approval of equipment for the project with the manufacturers' brochures.

g. Spare Parts Lists: Include a recommended spare parts list for all equipment furnished for the project. The parts list must include a tabulation of descriptive data for all the electrical-electronic spare parts and all the mechanical spare parts proposed for each type of equipment or system. Each part must be properly identified by part number and manufacturer.

h. Warranty: Include a copy of the “special” or extended warranty in the operation and maintenance manual.

E. Submittal, In both “hard” and electronic DVD or CD-ROM format:

1. Preliminary Submittal: Two draft copies of the completed manuscript for items in this outline must be submitted to the GENERAL SERVICES DIRECTOR OR DESIGNEE for review within 60 days after approval of equipment to be provided. One copy will be returned to the Contractor within 30] days after submittal and, if required, must be revised and resubmitted within 30 days.
2. Final Submittal: four complete sets of manuals must be furnished to the GENERAL SERVICES DIRECTOR OR DESIGNEE not later than 30 days before completion of the project.
3. Final Submittal must be accepted by the GENERAL SERVICES DIRECTOR OR DESIGNEE before training can begin.

1.2 POSTED OPERATING INSTRUCTIONS

A. General. Operating instructions and diagrams must be prepared for posting near the equipment. Posted operating instructions must be photographic or equal non-fading reproductions framed under glass or encased in non-discoloring plastic and must be mounted in locations as directed. Copies of the posted operating instructions must also be used with the O&M manuals as a basis for training City of Torrance personnel in the operation and maintenance of systems and related equipment installed under contract at the facility.

B. Posted operating instructions must consist of simplified, consolidated equipment, control, and power diagrams graphically representing the entire system and actual equipment installed, including concise written instructions on how to start and stop systems, what settings and conditions are to be observed, and what control adjustments are to be made or maintained by the operation. Posted operating instructions must include, but are not limited to the following:

1. Boiler and burner controls.
2. Refrigeration controls.
3. Heating, ventilating, and air-conditioning controls for each system.
4. Controls for dust collection systems.
5. One-line schematic diagrams of water supply (plumbing).
6. One-line diagrams of steam distribution and hot water and chilled water systems, including risers, main shutoff valves, balancing cocks, and the like.
7. One-line isometric diagrams of sanitary drainage.

1.3 TRAINING

A. The Contractor must train City of Torrance personnel in the operation and maintenance of mechanical and electrical equipment. Coordination must be maintained with systems designers for developing the hours of instruction and scope of material to be covered. Training of City of Torrance personnel must not begin until the GENERAL SERVICES DIRECTOR OR DESIGNEE has approved the final submittal copy of each O&M manual.

B. Schedule Submittal: The proposed scope of training and materials and instruction schedule must be submitted for review and approval approximately 30 days before the scheduled completion of the buildings. Mutually agreeable dates for training must be arranged with the GENERAL SERVICES DIRECTOR OR DESIGNEE, but the training must be completed before final acceptance of the facility.

C. Scope of Training: Training must include classroom and on-the-job instructions by qualified installation and maintenance personnel having the necessary knowledge, experience, and teaching skills. The use of record on digital media (DVD or CD discs) during the instruction period is required. Discs must be turned over to the GENERAL SERVICES DIRECTOR OR DESIGNEE after training has been completed.

D. Time Period of Training: The minimum specific hours of training time required for each category of major equipment and systems is indicated below. Past experience indicates a workable ratio in the vicinity of approximately 25 percent classroom to 75 percent application, except that the ratio may be reversed for control systems. The GENERAL SERVICES DIRECTOR OR DESIGNEE must have the option of redistributing the training times, subject to the total time specified. Training must be presented on an 8-hour per day, 5-day per week schedule, with all reading assignments and review to be within this period.

1.4 TRAINING PERIOD

Item	Time (Hours)
1. Roofing	2
2. Security Equipment	4
3. Overall Control System Covers central control center, coordinating respective controls of heating, cooling, and ventilation systems, and shows how these controls work together to provide an integrated overall control of the complete air-conditioning system, both heating and cooling, as well as all other utility control systems.	6
4. Electrical System Covers all building services, lighting, lighting controls, and intercommunications, and security system.	12
5. Piping and Plumbing Includes, but is not limited to, domestic water supply, storm and sanitary drainage systems, cold-water supply systems, sprinkler systems, and the like.	4
5. Miscellaneous Includes, but is not limited to, vehicle maintenance equipment, fire protection and alarm equipment, and all other equipment not specifically covered above.	2

1.5 TRAINING PARTICIPATION SHEETS

A. Submit to the GENERAL SERVICES DIRECTOR OR DESIGNEE sign-in sheets with the dates and names of all training participants. Training sheets must be reviewed and certified by an authorized facility manager.

1.6 OTHER CLOSEOUT SUBMITTALS

A. Additional requirements for Systems Manuals, Operating Instructions, Training and other deliverables are contained in individual Specification Sections. All closeout requirements must be provided to and accepted by the GENERAL SERVICES DIRECTOR OR DESIGNEE prior to requesting final payment. Examples of additional closeout requirements include, but are not limited to, the following
   1. Final Punch-List with all items certified as complete.
   2. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Record "As Built" Drawings*, the Contractor shall submit certified As-Built Record Drawings and Specifications in the quantities and media specified.

3. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Warranty*, the Contractor shall submit all transferable guarantees and warranties for equipment, materials and installations furnished by any manufacturer, supplier, or installer.
4. Signed Asbestos and Lead-Based Paint Certificate.
5. Certification of Accessibility (CoA) and Facility Accessibility Survey Report.
6. Material Safety Data Sheets.
7. Signed and sealed Contractor Release of Claims.
8. [ ]

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 02 4119

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures for demolition and removal of existing building elements.
   2. Removal of designated building equipment and fixtures.
   3. Salvaged items.
   4. Salvaged material.
   5. Salvaged items for re-use.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 01 3543 - Environmental Procedures: Recycling and reuse of waste materials.
   2. MUST PROVIDE ASBESTOS AND LEAD TESTING RESULTS PRIOR TO ANY DEMO.
   3. MUST ALL BE ABATED BY A LICENSED COMPANY.

1.2 SYSTEM DESCRIPTION

A. The extent of Selective Demolition Work is that Work necessary, and required to facilitate the new construction indicated.

B. Demolition shall be such that all construction, new and existing, can be performed, and completed in accordance with the construction documents.

C. The contractor shall visit the project site and familiarize himself with the existing conditions and project requirements.

D. Verify the scope of the Work under this Section including salvage material. The City of Torrance will be responsible for removing all materials and equipment which the City of Torrance wishes to salvage prior to the beginning of this Work.

1.3 QUALITY ASSURANCE

A. Engage only personnel who can demonstrate not less than five years successful experience in Work of similar character.

B. Performance Criteria:
   1. Requirements of Structural Work: Do not cut structural work in a manner resulting in a reduction of load-carrying capacity of load/deflection ratio.
   2. Operational and Safety Limitations: Do not cut operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in a manner intended or resulting in a decreased operational life, increased maintenance or decreased safety.
   3. Visual Requirements: Do not cut work which is exposed on the exterior or exposed in occupied spaces of the building in a manner resulting in a reduction of visual qualities or resulting in

substantial evidence of the demolition work judged by the Architect to be cut and patched in a visually unsatisfactory manner.

4. Loading: Do not superimpose loads at any point upon existing structure beyond design capacity including loads attributable to materials, construction equipment, demolition operations and shoring and bracing.
5. Vibration: Do not use means, methods, techniques or procedures which would induce vibration into any element of the structure.
6. Fire: Do not use means, methods, techniques or procedures which would produce any fire hazard unless otherwise approved by General Services Director or Designee.
7. Water: Do not use means, methods, techniques or procedures which would produce excessive water run-off, and water pollution.
8. Air Pollution: Do not use means, methods, techniques or procedures which would produce uncontrolled dust, fumes or other damaging air pollution.

1.4 PROJECT SITE

A. Indicated "Existing Construction" was obtained from existing drawings or other information which may not reflect actual conditions. The Contractor shall verify all existing conditions and notify the General Services Director or Designee of discrepancies before proceeding with the Work.

B. Perform the removal, cutting, drilling, etc., of existing work with extreme care, and using small tools in order not to jeopardize the structural integrity of the building.

C. Occupancy: Contractor shall not have full use of the facility during construction.

D. Condition of Structure: The City of Torrance assumes no responsibility for the actual condition of portions of the structure to be demolished.

E. Partial removal: Items of salvageable value to the Contractor may be removed from the structure as the work progresses if not claimed by the City of Torrance. Salvaged items must be transported from the site as they are removed.

F. Protection: Make sure that the safe passage of persons around the area of demolition is maintained during the demolition operation. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

1.5 PROTECTION OF EXISTING CONSTRUCTION

A. Provide temporary protection of existing construction (floors, roof, and walls) when adjoining new work and in traffic areas.

B. Provide temporary construction, constructed of framing and plywood, to protect existing construction and surrounding surfaces from damage by movement of materials and personnel.

C. The contractor is responsible for all damage to existing structure and shall replace or repair all areas of damage.

D. Repair, replace, or rebuild existing construction as required or as directed which has been removed, altered or disrupted to allow for new construction. Existing construction shall be corrected to match adjacent construction, new or existing.

E. Perform cutting of existing concrete and masonry construction with saws and core drills. Do not use jack-hammers or explosives.

1.6 SHORING AND BRACING

A. Provide temporary shoring of existing construction to allow removal of existing structural elements. Maintain shoring until new structural elements are in place and accepted.

PART 2 - PRODUCTS

2.1 SALVAGED ITEMS

A. The Contract Documents indicate the existing materials that are to be reinstalled in the new construction. The Contractor shall remove, protect and reinstall these items as indicated.
   1. Items for "Reinstallation" will be indicated as such within the Contract Documents.

B. Materials scheduled for reinstallation which are damaged by the Contractor to the extent that they cannot be reinstalled shall be replaced by the Contractor with equal quality material at no additional cost to the City of Torrance.

C. Coordinate with the General Services Director or Designee on disposition of salvage items note scheduled for reinstallation, demolished materials, and equipment. Salvaged materials, not reinstalled, shall be delivered, as directed, to the City of Torrance.

2.2 SALVAGED MATERIALS

A. Removed and salvaged materials of value not designated for reinstallation, unless claimed as salvage by the City of Torrance, shall become the property of the Contractor and shall be removed from the premises by the Contractor and recycled, reused or disposed of as specified in Section 01 3543 - Environmental Procedures.

B. The City of Torrance will remove or, under separate contract, have all materials and equipment which the City of Torrance requires removed prior to Work under this Section begins.

2.3 SALVAGED ITEMS FOR RE-USE

A. Materials and items scheduled for re-use which are damaged by the contractor to the extent which they cannot be re-used shall be replaced by the Contractor at no additional cost to the City of Torrance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Temporary Support: Provide adequate temporary support for work to be cut to prevent failure. Do not endanger other work.

B. Provide adequate protection of other work during selective demolition to prevent damage and provide protection of the work from adverse weather exposure.

3.3 PROCEDURE

A. Employ only skilled tradesmen to perform selective demolition.

B. Cut work by methods least likely to damage work to the retained and work adjoining.

C. In general, where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete and masonry work.

D. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.

E. Where selective demolition terminates at a surface or finish to remain, completely remove all traces of material selectively demolished, including mortar beds. Provide smooth, even, substrate transition.

3.4 POLLUTION CONTROLS

A. Use temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.

B. Comply with governing authorities pertaining to environmental protection.
   1. Protect natural resources as specified in Section 01 3543 - Environmental Procedures.

C. Clean adjacent portion of the structure and improvement of dust, dirt and debris caused by demolition operations, as directed by General Services Director or Designee and governing authorities. Return adjacent areas to conditions existing prior to the start of the work.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the City of Torrance in the Solid Waste Management and Environmental Protection Plan.

3.6 SCHEDULE OF SELECTIVE DEMOLITION

A. Slab on Grade:
   1. Where indicated, saw cut perimeter of existing slab minimum of 50 percent of slab thickness to provide a breaking point to remove existing concrete.

2. Break concrete slab to be removed into portions easily removed, maximum 3 foot dimensions in any side.
3. Remove all concrete pieces within removed area down to the existing subgrade.

B. Exterior Masonry:
1. Locate portion of existing masonry wall to be removed.
2. Using small power tools, remove only that portion of the exterior wall which is required for the indicated new construction.

C. Interior Floor Finishes:
1. Remove all interior floor tile finish material unless otherwise indicated on drawings.

D. Interior Walls and Partitions:
1. All interior wall and partitions shall be removed unless otherwise indicated on drawings.
2. Remove all top and bottom framing tracks and over head braces.

E. Plumbing:
1. Remove all plumbing fixtures and accessories including all exposed supply, waste, and vent piping unless otherwise indicated on drawings.
2. Concealed piping within and below slab construction shall be identified, and capped a minimum of 3 inches (8 cm) below finish floor.

F. Electrical Service:
1. Remove all abandoned electrical conduit, boxes, and wiring back to the existing electrical service which is to remain.

G. Provide additional selective demolition as indicated and required by the Contract Documents and as required for indicated new construction.

END OF SECTION

SECTION 031000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
   2. Openings for other work.
   3. Form accessories.
   4. Form stripping.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 032000 - Concrete Reinforcement: Coordination between formwork and reinforcement.
   2. Section 033000 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this section.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 - Structural Concrete for Buildings.
   2. ACI 318 - Building Code Requirements for Reinforced Concrete.
   3. ACI 347 - Recommended Practice For Concrete Formwork.

B. United States Department of Commerce Product Standard (PS):
   1. PS 1 - Construction and Industrial Plywood.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Provide data on void form materials and installation requirements. Submit data on form-coating materials.
   2. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

B. Where necessary, design formwork under direct supervision of a Professional Engineer experienced in design of formwork and licensed in State where Project is located.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver void forms and installation instructions in manufacturer's packaging.

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

1.6 ENVIRONMENTAL REQUIREMENTS

A. Environmental Impact:
   1. Formwork: Reuse forms to greatest extent possible without damaging structural integrity of concrete and without damaging aesthetics of exposed concrete.

PART 2 - PRODUCTS

2.1 WOOD FORMS

A. Forms for Exposed Finish Concrete: Plywood panels, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
   1. Plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Lumber: Construction grade; with grade stamp clearly visible.

2.2 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Void Forms (Carton Forms): Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set. Thickness indicated on drawings.

C. Tubular Column Type: Metal or fiberglass-reinforced plastic. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

2.3 ACCESSORIES

A. Form Ties: Factory-fabricated, removable or snap-off type, metal, of fixed or adjustable length as applicable, with cone ends. Designed to prevent form deflection and to prevent spalling concrete upon removal. Back break dimension, 1-1/2 inch from exposed concrete surface. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

B. Form Release Agent: 100 percent biodegradable colorless agent which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of subsequent coatings intended for use on concrete surfaces. Zero VOC.
   1. Envirolux by Conspec, Kansas City, KS, (800) 348-7351 or (913) 287-1700.

2. SMD-10 Soy Form Release by Strategic Market Development (800) 959-1071 or (815) 935-0863.
3. Bio-Form by Leahy-Wolf, Franklin Park, IL, (888) 873-5327 or (847) 455-5710.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

C. Corners: Chamfered, wood strip 3/4 x 3/4 inch size; maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
1. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 FORMWORK INSTALLATION

A. Install formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347R.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Furnish in largest available sizes to minimize number of joints and to conform to joint system indicated on Drawings.

E. Obtain Contracting Officer approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners of concrete members, to produce uniform, smooth lines and tight edge joints.

G. Install void forms in accordance with manufacturer's published instructions. Protect forms from moisture or crushing.

3.4 FORM RELEASE AGENT APPLICATION

A. Apply form release agent on formwork in accordance with manufacturer's published instructions.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's published instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 CONSTRUCTION

A. Site Tolerances:
   1. Construct formwork to maintain tolerances required by ACI 301 and ACI 347.
   2. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection and testing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 032000

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing steel bars.
   2. Steel wire fabric.
   3. Reinforcement accessories.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 031000 - Concrete Forming and Accessories: Coordination between formwork and reinforcing.
   2. Section 033000 - Cast-in-Place Concrete: Coordination between concrete placement and reinforcing.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 - Structural Concrete for Buildings.
   2. ACI 318 - Building Code Requirements For Reinforced Concrete.
   3. ACI SP-66 - American Concrete Institute - Detailing Manual.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
   3. ASTM A 704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

C. American Welding Society (AWS):
   1. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI - Manual of Practice.
   2. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
   3. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

A. Section 013300 – Submittal Procedures: Procedures for submittals.
   1. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.
   2. Assurance/Control Submittals;
      a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
      b. Submit certified copies of mill test report of reinforcement materials analysis.

c. Welder's Certificates.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.

B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.

C. Welders' Certificates: Submit certificate, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Resource Management
1. Recycled Content
a. Steel Products: Post-consumer recycled content plus one half of pre-consumer recycled content not less than 25% percent.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Steel: ASTM A 615, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Reinforcing Steel Mat: ASTM A 704, ASTM A 615, 60 ksi yield grade; steel bars or rods, unfinished.

C. Reinforcing Steel Mesh: ASTM A185; 6X6, w 1.4 X w 1.4.
D. Dowels at Construction Joints: 1/4" x 4.5" Diamond Dowels by PNA Construction Technologies or approved equal.

2.2 ACCESSORIES

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type(CRSI, Class 1) or stainless steel protected(CRSI, Class 2); size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI SP-66 and ACI 318.

B. Weld reinforcement in accordance with AWS D1.4.

C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Contracting Officer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

C. Report in writing to the General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing in accordance with ACI 318.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

B. Inspect reinforcing locations, bar types and sizes, wire ties, and welding (if applicable).

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes all labor, materials and appliances, and perform all operations in connection with the installation of Concrete Work, and all related work incidental to the completion thereof, as shown on the drawings, complete, in strict accordance with the drawings and as specified herein. Section Includes:

1. Cast-in-place (CIP) concrete in building frame elements, walls, foundations, foundation walls, slabs-on-grade, and mechanical equipment pads.
2. Finishing of concrete floor slabs and toppings. Concrete liquid surface treatment, sealer, and slip-resistant coatings.
3. Expansion and contraction, control joints in CIP concrete.
4. Concrete curing and protection.
5. Non-shrink grout including installation and forming.
6. Testing related services.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents and References in Section 1.2.

C. Related Sections: Related work specified elsewhere includes but may not be limited to
1. Section 03 2000: Concrete Reinforcement

1.2 REFERENCES

A. American Concrete Institute (ACI) Codes and Standards latest editions:
1. ACI 117, “Standard Specification for Tolerances for Concrete Construction and Materials.”
2. ACI 301, “Specification for Structure /Concrete.”
3. ACI 302.1R, “Guide for Concrete Floor and Slab Construction.”
4. ACI 304R, “Guide for Measuring, Mixing, Transporting, and Placing Concrete.”
5. ACI 305, “Hot Weather Concreting.”
6. ACI 306, “Cold Weather Concreting.”
7. ACI 311, “Recommended Practice for Concrete Inspection.”
8. ACI 315, “Details and Detailing of Concrete Reinforcement.”
9. ACI 318, “Building Code Requirements for Structural Concrete.”
10. ACI 347, “Guide to Formwork for Concrete.”

B. American Welding Society (AWS)
1. AWS D1.4, "Structural Welding Code Reinforcing."

C. American Society for Testing and Materials (ASTM).
1. ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
2. ASTM C33, "Standard Specification for Concrete Aggregates."
3. ASTM C94, "Standard Specification for Ready-Mixed Concrete."
4. ASTM C150, "Standard Specification for Portland Cement."
5. ASTM C260, "Standard Specification for Air Entraining Admixtures for Concrete."

6. ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
7. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete."
8. ASTM C618, "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
9. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in

D. Concrete Reinforcing Steel Institute (CRSI),
   1. CRSI "Manual of Standard Practice."

1.3 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Provide data technical, testing, and source for mix design materials and additives, steel reinforcement, joint sealant ,and other products as specified on the drawings.]
   2. Shop Drawings: Provide shop drawings for reinforcement, layout, detailing, and placing prior to fabrication, site delivery, and installation.
      a. Mix design submittals.

   3. Assurance/Control Submittals:
      a. Test Reports: Prepare reports in conformance with Section 01 4000 - Quality Requirements:
      b. Submit laboratory test reports for concrete materials and mix designs for each strength and type of concrete proposed for use.
      c. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
   4. Delivery Tickets:
      a. Copies of delivery tickets for each load of concrete delivered to site.
      b. Indicate on each ticket the exact time that the mix is batched.
      c. Mix identification number on ticket shall match number on submitted and approved mix design
      d. Submit copies to Testing Laboratory for verification of compliance with placing time.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the Codes and Standards referenced in section 1.2 of this specification.
   1. Provide qualification data for manufacturers and installers.

B. Pre-Installation Conference:
   1. Conduct a pre-installation conference prior to commencing Work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials in unopened containers with labels identifying contents.

C. Store powdered materials in dry area and in manner to prevent damage. Protect liquid materials from freezing or exceeding maximum storage temperatures set by product manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Applied Concrete Technology, Inc., Post Office Box 548, Grayslake, IL 60030, Toll Free: 800-228-6694, Phone: 847-548-2444, Fax: 847-548-2555. www.protecrete.com
2. The Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110, Phone: 216-1-9222, Toll Free: (800) 321-7628, Fax: 216-531-9596 www.euclidchemical.
3. Fortifiber Corporation, 419 W. Plumb Lane, Reno, NV 89509, Toll Free: 800-773-4777, Fax: 775-333-6411, Website: www.fortifiber.com.
4. ChemRex Inc., Shakopee, Minnesota 55379, Toll Free: 800-433-9517, Fax: 800-496-6067.
5. BASF Construction Chemicals North America (former Master Builders), 23700 Chagrin Boulevard, Cleveland, OH 44122, Phone: 216-839-7500, Fax: 216-839-8821.
6. W.R. Meadows, Inc., PO Box 338, Hampshire, Illinois 60140-0338, Toll Free: 800-342-5976, Phone: 847-683-4500.
7. Reef Industries, 9209 Almeda Genoa, Houston, Texas 77075, Phone: 713-507-4251, Toll Free: 800-231-6074, Fax: 713-507-4295.
8. Stego Industries LLC, 27442 Calle Arroyo Suite A, San Juan, Capistrano, CA 92675, Phone: 877-464-7834, Fax: 949-493-5165, www.stegoindustries.com.
9. L & M Construction Chemicals, Inc. 14851 Calhoun Rd., Omaha, NE 68152-1140; Phone: 402-453-6600, Fax: 402-453-0244.
10. Curecrete Chemical Company, Inc., 1203 W. Spring Creek Pl., Springville, UT Phone: 801- 489-5663.
11. Midwest Floor Care Inc., 17202 Princeton Rd, Adams, NE 68301, Phone: 402-788-2820.
12. General Resource Technology, Inc., 2978 Center Court, Eagan, MN 55121, Phone: 800-324-8154, Fax: 651-454-4252, www.grtinc.com.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 – Type II.

B. Liquid admixtures: The following admixtures are permitted when approved in writing prior to use or are required as specified herein and shall be used in strict accordance with the manufacturer's specifications or recommendations:

1. Calcium chloride: Conform to ACI 301. The water soluble chloride ion level shall not exceed 0.3 percent by weight of cement.
2. Air-entraining admixtures: ASTM C260 For steel hard trowel interior slab finish, do not use air entrainment admixtures.
3. Water-reducing admixtures: Conform to ASTM C494, Type A.
4. Water-reducing/accelerating admixtures: Conform to ASTM C494, Type C or E.
5. Water-reducing/retarding admixtures: Conform to ASTM C494, Type D.
   a. High-range/water-reducing (HRWR) admixtures: Conform to ASTM C494, Type F or G super plasticizers. HRWR admixture shall be used in concrete with a maximum water/ cement ratio of 0.50 or less.

C. Fly ash: Conform to ASTM C618. The use of a quality fly ash will be permitted as a cement-reducing admixture (minimum 15 percent and maximum 25 percent) unless otherwise restricted by the engineer.

Fly ash used in concrete shall be from a single source and of a single class in combination with Portland cement of a single source and single class unless otherwise approved by the Engineer.

D. Granulated Blast Furnace Slag is an alternative to fly ash and shall conform to ASTM C989 Grade 100 0r 120. Granulated blast furnace slag may be used as a substitute for a maximum of 30 percent of Portland cement.

E. Aggregates:
   1. Normal-weight concrete - ASTM C33.
   2. Light-weight concrete – ASTM C330.
   3. Aggregates shall be from a single source.

F. Water:
   1. Clean, potable, and free of injurious amounts of oil, acid, alkali, organic or other deleterious matter not detrimental to concrete; drinkable.

2.3 GROUT/MORTARS

A. Cement grout: Conform to ASTM C387 "Dry packaged mixtures”.

2.4 CURING/SEALING/HARDENERS

A. Dissipating liquid membrane-forming compounds for curing concrete; Conform to ASTM C309, Type 1. Curing compound shall be compatible with floor sealer or finish used. Low VOC.

B. Method of curing shall be approved by the finish flooring applicator where finishes are indicated.

C. Exterior Sealers: applied to horizontal concrete surfaces permanently exposed to salts, deicer chemicals and moisture, including parking decks. The manufacturer shall provide a five year labor and materials warranty on performance of the sealer. Sealer shall be compatible with the curing compound used.

D. Liquid Densifier/Sealer/Hardener: to be applied on exposed concrete floors cured with dissipating membrane forming curing compound to harden and densify concrete surfaces. Sealers are to be clear, chemically reactive, a waterborne solution of silicate or siliconate materials and proprietary components, odorless, and colorless.

2.5 JOINTS AND EMBEDDED ITEMS:

A. Construction and Contraction Joints: Sealant shall be two-part semi- rigid epoxy, and shall have minimum Shore A Hardness of 80 when measured with ASTM D2240.

B. Isolation Joints: Fillers shall consist of 1/8 inch width strips of neoprene, synthetic rubber, or approved substitute, extending the full depth of the slab. Sealant shall be two-part elastomeric type, polyurethane base.

2.6 VAPOR BARRIER/RETARDER

A. Provide cover over prepared soil, above aggregate subbase material at slabs-on-grade, where shown on the plans with a minimum thickness of 10 mils.. Use only materials which are resistant to decay.

2.7 PROPORTIONING

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

B. Submit written reports to the testing laboratory of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed and approved.

C. Concrete types and strengths: Minimum 28 Day Compressive Strength shall be per design requirements but not less than:
1. Paving base, columns, beams, walls, foundations, and footings: 3,500 psi.
2. Slab-on-grade:4,000 psi.
3. Normal or Lightweight concrete on metal deck: 3,000 psi.
4. Tilt-up: 4,000 psi.
5. All concrete exposed to weather shall be air entrained (ASTM C260).
6. All concrete shall be normal weight except as noted above.

D. Durability: Conform to ACI 301.
1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to de-icer chemicals is to be air-entrained, [ ] ±1percent.,
2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added.

E. Slump: Conform to ACI 301 and to specific project mix requirements.

F. Production of concrete: Conform to ACI 301:
1. Cast-in-place concrete used in the work shall be produced at a single off-site batching plant or may be produced at an on-site batch plant.
2. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes.
3. Prior to adding a high-range water reducer (super plasticizer), slump shall not exceed the working limit.
4. Ready-mixed and on-site batched concrete shall be batched, mixed, and transported in accordance with ASTM C94.
    a. The concrete producer shall furnish duplicate delivery tickets, one for the Contractor and one given to the General Services Director or Designee for each batch of concrete. The information provided on the delivery ticket shall include the quantity of materials batched including the amount of free water in the aggregate and any water added onsite. Show the date, time of day batched, and if ready-mixed the time of discharge from the truck. The quantity of water that can be added at the site without exceeding the maximum water-cementitious ratio specified shall be noted on the delivery ticket.
5. For concrete produced on site with a central batch plant, mixing shall be done in an approved batch mixer concrete shall be batched, mixed, and transported in accordance with ASTM C94.
6. Variations in consistency during the discharge of a single batch shall not exceed 1 inch of slump, except that a greater variation will be permitted if the slump of the concrete decreases and no water is added.
7. All other concrete: Conform to ACI 301
8. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.

9. Ensure air content for slabs with steel trowel finish is less than 3.0 percent.
10. No water shall be added to concrete except under the direct awareness of the project inspector.
11. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor for approval by the Civil Engineer at no additional cost to General Services Director or Designee. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.

2.8 FORMWORK

A. Section 03 1000: Concrete Forming and Accessories

2.9 REINFORCING MATERIALS

A. Section 03 2000: Concrete Reinforcement

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION - GENERAL

A. Install all cast-in-place concrete work in accordance with ACI 301 except as herein specified.

B. All bearing materials shall be inspected by the Civil Engineer prior to placing concrete. The Civil Engineer specify site preparation requirements and provide recommendations to the Architect/Civil Engineer prior to placing concrete.

C. Immediately before placing concrete, spaces to be occupied by concrete shall be free from standing water, ice, mud, and debris.

D. Concrete shall not be deposited under water or where water in motion may injure the surface finish of the concrete.

E. Forms and the reinforcement shall be thoroughly cleaned of ice and other coatings. Remove surplus form releasing agent from the contact face of forms.

F. Notify all trades concerned and the General Services Director or Designee sufficiently in advance of the scheduled time for concrete placement to permit installation of all required work by other trades.

G. Before placing concrete, all required embedded items, including dovetail anchor slots, anchors, inserts, curb angles, metal frames, fixtures, sleeves, drains, stair nosings, accessory devices for Mechanical and Electrical installations shall be properly located, accurately positioned and built into the construction, and maintained securely in place.

H. Build into construction all items furnished by the City of Torrance and other trades. Provide all offsets, pockets, slabs, chases and recesses as job conditions require.

I. Place and properly support reinforcing steel and anchor bolts.

J. The alignment, orientation, spacing, and embedment length of mechanical load transfer devices in slab-on-grade and pavements shall conform to dimensions and tolerances shown on the drawings.

3.3 INSTALLATION - FORMWORK

A. Section 03 1000 Concrete Forming and Accessories

B. Construction and Contraction Joints: Conform to ACI 301 and recommendations of ACI 302.1R.

3.4 REINFORCEMENT

A. Placement: Section 03 2000 Concrete Reinforcement

3.5 METHODS OF PLACEMENT AND PLACING CONCRETE

A. Placement: Conform to ACI 301:
   1. Concrete shall be placed within 90 minutes after the water has been added to the cement and aggregates. Concrete shall be placed prior to initial concrete set.
   2. Placing of concrete will not be permitted during rainfall or when rain appears imminent. If rain should fall subsequent to placement, the concrete shall be completely protected until curing is complete.
   3. Cold-Weather Placement: Comply with provisions of ACI 306.1 “Standard Specifications for Cold-Weather Concreting” for placement at temperatures below 40 deg F (4 deg C).
      a. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
      b. Concrete shall not be placed on frozen ground or placed when the ambient temperature is 40 deg F or less and dropping.
      c. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures using vented heaters and insulating blankets.
      d. Concrete temperatures shall be maintained above 50 degrees F for the first 7 days of curing.
   4. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R “Standard Specification for Hot-Weather Concreting” for placement at temperatures above 90 deg F (32 deg C).
      a. Reject any concrete that has a temperature at the point of placement above 90 deg F unless approved otherwise by the Civil Engineer. When air temperatures are between 80 and 90 deg F the maximum mixing and delivery time is reduced to 75 minutes. When air temperatures exceed 90 deg F, the maximum mixing and delivery time is reduced to 60 minutes.
      b. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Civil Engineer.

B. Depositing Concrete
   1. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing.
   2. The number, type, position, and design of joints shall be approved by the Civil Engineer prior to concrete placement.
   3. The concreting shall be carried on at such a rate that the concrete is plastic at all times and flows readily into the spaces between reinforcing bars. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work
   4. When concreting is started, it shall be carried on as a continuous operation until the placing of the section is completed.
   5. Except as intercepted by joints, concrete shall be placed in continuous layers.
   6. Field records shall be kept of the time and date of the placing of each concrete pour. Locations where concrete test cylinders are made shall also be recorded. Records shall be kept on file at the job until its completion and shall be subject to the inspection of the General Services Director or Designee at all times.

C. Joints
   1. Joints shall be vertical in walls and horizontal in slabs [unless otherwise specified on the drawings].
   2. Dowel bars and tie bars shall be inspected
   3. Control joints for controlling concrete shrinkage shall be provided in floor slabs, walls, decks, conduits, and channels as shown on the plans or approved by the Civil Engineer.
   4. Joint spacing and sawcut depth for slab-on-grade and concrete pavement shall conform to that shown on the pour sequencing plan and/or drawings.
      a. Sawed control (contraction) joints for pavements and slab-on-grade shall be installed as soon as practical so as not to ravel the concrete but less than 12 hours.
      b. Joint spacing shall in feet shall not exceed 2-1/2 times the slab thickness in inches unless otherwise approved by the Civil Engineer.
   5. Joints in slabs shall align with joints in adjoining walls unless otherwise approved by the Architect/Civil Engineer or shown in the drawings. Joints shall also line up with architectural reveals and form lines. All corners shall be relieved by cutting joint to adjacent control joint.
   6. If there is a delay in casting but prior to concrete initial set, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints.
   7. Where placing concrete is interrupted long enough for the concrete to take its initial set, the working face shall be made a construction joint.
      a. Preparation and disposition of unplanned cold joints in walls shall be approved by the Civil Engineer.
      b. For slab-on-grade, pavements, sidewalk, and curb and gutter, concrete shall be removed back to the nearest planned joint and a construction joint installed.
   8. Unless otherwise noted on the drawings, where concrete is to be placed against existing concrete, except in the case of expansion joints, the joint face of the existing concrete shall be roughened.
   9. Corner sections of walls shall not be placed until the adjoining wall sections have cured at least 14 days.

D. Consolidation
   1. All concrete shall be thoroughly consolidated by internal mechanical vibrators during the placing operation and shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of the forms.
   2. Consolidation shall be carried on continuously with the placing of concrete.
   3. The vibrator shall be kept in nearly a vertical position as practible. The use of vibrators to shift or drag concrete after deposition will not be permitted. Vibrators shall not be laid horizontally or laid over.
   4. Concrete shall not be placed until the previous layer has been vibrated.
   5. Unless directed otherwise by the Civil Engineer, the top 2 feet of walls shall be re-vibrated approximately 1 hour after placement of concrete and while a running vibrator will still sink under its own weight into the concrete and liquefy it momentarily.

E. Protection of cast concrete: Conform to ACI 301.
F. Repair of surface defects: Conform to ACI 301.

3.6 FINISHING

A. Finishing of formed surfaces: ACI 301:
   1. Tops of forms:
      a. Strike concrete smooth at tops of forms.
      b. Float to texture comparable to formed surfaces.
   2. Formed surfaces:
      a. Finished formed surfaces shall conform accurately to the shape, alignment, grades, and sections shown on the drawings or prescribed by the Civil Engineer.
      b. Surfaces shall be free from fins, bulges, ridges, honeycombing, or roughness of any kind and shall present a finished, smooth, continuous hard surface.
      c. Rough form finish at unfinished areas unexposed to public view. Smooth form finish at surfaces exposed to public view.

B. Slabs: Minimum slab surface tolerance must satisfy ACI 301 and ACI 302.1R.
   1. Slabs-on-grade:
      a. For exposed slabs, install semi-rigid epoxy sealant in construction and contraction joints after slab has a minimum of 60 days or otherwise approved by the Civil Engineer.
      b. Allowable tolerance for slab on grade surfaces, measured in accordance with ACI 117 shall meet or exceed an overall value of FF35/Fl25, with minimum local value of FF24/FL17.
   2. Suspended Floor Slab:
      a. Minimum surface tolerances: FF25 & FL20 overall and FF20 & FL15 local.
   3. Concrete Finishes:
      a. Floor Slabs: Steel trowel finish unless otherwise noted on the plans.
      b. Exposed concrete slabs sealed or sealed and hardened using a liquid compound compatible with the curing method used.
      c. Exterior Concrete Finishes: Unless otherwise noted on the drawings, floors, walkways, and roof finishes shall be sloped a minimum 0.125 inch per foot to drain water. A light steel trowel with broom finish unless otherwise noted on the plans. Apply exterior sealer to surfaces exposed to deicer chemicals that is compatible with the curing method used.
      d. Exposed Ramps, Landings and Stair Treads: A light steel trowel with broom finish unless otherwise noted on the plans. Surfaces shall be sealed or sealed and hardened using a liquid compound compatible with the curing method used.
      e. A heavy broom finish shall be provided on disabled person ramps, utility ramps, and around exterior loading docks.

3.7 CURING, PROTECTION, LIQUID HARDNERS AND SEALERS

A. Temperature, Wind, and Humidity
   1. When concrete slabs and other unformed concrete is placed in warm, dry, dusty, or windy conditions, concrete surfaces shall be protected from rapid drying by use of windbreaks, shading, fogging with properly designed nozzles, or a combination of these measures. Hot weather concreting procedures provided in ACI 305R shall be used when ambient conditions dictate.
   2. Cold weather concreting procedures provided in ACI 306R shall be used when ambient conditions dictate.

B. Curing Compound
   1. All curing methods shall be placed [within two hours] after final finishing. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven days.

2. Apply the specified curing compound in accordance with manufacturer's written instructions.
3. When used on an unformed concrete surface, application of the first coat of curing compound shall commence immediately after finishing operations have been completed. When curing compound is used on a formed concrete surface, the surface shall first be moistened with a fine spray of water immediately after the forms have been removed.
    a. Surfaces shall be sprayed uniformly with 2 coats of curing compound. As soon as the first coat has become dry, a second coat shall be applied in the same manner. The direction of application of the second coat shall be perpendicular to the first coat.
4. Curing compound shall not be used on any concrete surface specified to receive additional concrete, coatings, grout, and chemical treatment

C. Protection
1. Freshly placed concrete shall be protected against wash by rain.
2. Dust control shall be provided in the surrounding areas during placement.
3. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted unless otherwise approved by the Civil Engineer.
4. The contractor shall allow no traffic and take precautions to avoid damage to the membrane of the curing compound for a period of not less than 28 days. Damage shall be repaired immediately.
5. Self-supporting structures shall not be loaded in such a way to overstress the concrete.

D. All floor slabs shall be cured using products and methods compatible with selected floor adhesives, toppings, and other finish materials.

E. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

F. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete according to manufacturer's written instruction.

3.8 PATCHING AND REPAIR

A. All repairs of defective areas shall conform to ACI 301. On areas requiring treatment of defects and until such repairs have been completed, only water cure will be permitted

B. At any time prior to final acceptance, concrete found to be defective, damaged, or not in accordance with the specifications shall be repaired or removed and replaced with acceptable concrete.

C. Repair or replace concrete with excessive honeycombing due to improper placement.
1. If approved, a bonding admixture, bonding compound, or epoxy adhesive may be used in accordance with the manufacturer's preparation and application recommendations. Comply with ACI 301 and ACI 503.2 for standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.
2. The repair concrete shall be thoroughly consolidated in place and struck off so as to leave the patch slightly higher than the surrounding surface. The concrete shall be left undisturbed for at least 1 hour to permit initial shrinkage then finished.
3. The patched area shall be kept damp for 7 days.
4. The color of the patch material shall match the color of the surrounding concrete. Repairs shall be made promptly while the base concrete is less than 28 days old.

D. Areas showing excessive defects as determined by the Architect/Civil Engineer shall be removed and replaced.

E. High spots identified in the floor flatness and levelness survey may be removed with bump grinding. Areas to be ground shall not exceed more than 10 percent of any one slab nor more than 5 percent of the total slab-on-grade area.

F. If approved by the Architect/Civil Engineer, concrete slab random cracking may be routed and sealed. Slabs with more than one structural crack or with multiple cracks within a slab shall be removed and replaced. If random cracks are attributed to non-working sawcut control joints, uncracked joints parallel to the cracking shall be filled with a structural epoxy.

G. Interior slab-on-grade subjected to lift truck traffic shall be routed and sealed with a semi-rigid epoxy sealant. Exterior slabs may be routed and sealed with the flexible joint sealant to be installed in pavement joints.

3.9 GROUTING

A. After steel columns have been installed and leveled, grout the space between the bottom of the plate and concrete, using cement grout completely filling the space and forming solid bearing for the column base plate.

3.10 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Comply with ACI 301, ACI 318-Chapter 5 and ACI 311 for compressive strength, slump, and frequency of testing.

B. The frequency of testing indicated in the aforementioned codes and standards shall be increased if concrete fails to meet the acceptance criteria or if deemed by the Civil Engineer to be too variable.

3.11 ACCEPTANCE OF STRUCTURE

A. Comply with ACI 301 and modifications in this section.

B. Completed concrete work, which meets all applicable requirements, will be accepted without qualification.

C. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

D. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected by the General Services Director or Designee. In this event, modifications may be required to assure that remaining work complies with the requirements.

E. The costs of any additional tests or analysis, including additional architectural and engineering services, performed to prove the adequacy of the concrete work, shall be borne by the Contractor without extension of contract time.

3.12 MISCELLANEOUS CONCRETE

A. Curbs: Provide monolithic finish to interior surface of curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

B. Equipment bases and foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Requirements:

1. Provide and maintain an adequate program of quality control for the materials, production methods, and workmanship to assure conformance of all work to the project contract documents.
2. Testing and Evaluation:
    a. Furnish and pay for the services of an independent Testing Laboratory satisfactory to the General Services Director or Designee. The testing laboratory shall have prime responsibility for review, verification inspection, and testing of the concrete producer's materials, operations, facilities, and quality control procedures and evaluating the results for conformance with these specifications.
    b. In addition to the requirements and duties in ACI 301 the testing laboratory shall provide the following:
        a. One or more additional test cylinders shall be taken during cold weather concrete placement and cured on the job site under conditions of concrete represented to determine safe form-stripping period.
        b. Inspect concrete batching, mixing, and delivery operations periodically or as directed by the General Services Director or Designee.
        c. Submit to the General Services Director or Designee and concrete producer, during construction, the results of concrete tests.
    c. The Testing Laboratory shall assess and report floor flatness and levelness in accordance with the requirements of this specification.
    d. Field and concrete plant inspections are to be made by a competent representative of the Testing Laboratory during all structural concreting operations including periodic audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill specification requirements, the Testing Laboratory is to report such deficiency immediately to the General Services Director or Designee and appropriately record it in his report.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel framing members, support members, with required bracing, welds, and fasteners.
2. Base plates.
3. Grouting under base plates.

B. Related Sections:
1. Section 052100 - Steel Joist Framing: Steel bracing for joists and joist girders.
2. Section 053100 - Steel Decking: Support framing for small openings in deck.
3. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC):
1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. AISC - Code of Standard Practice - Manual of Steel Construction - Allowable Stress Design (ASD).
3. AISC - Section 10 - Architecturally Exposed Structural Steel.

B. American Society for Testing and Materials (ASTM):
1. ASTM A36/A36M - Specification for Structural Steel.
2. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
4. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153 - Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
6. ASTM A242/A242M - Specification for High-Strength Low-Alloy Structural Steel.
7. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
8. ASTM A 325 - Specification for Structural Bolts, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.
10. ASTM A490 - Specification for Heat-Treated Steel Structural 150 ksi Minimum Tensile Strength.
11. ASTM A 500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A 501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
13. ASTM A514/A514M - Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
14. ASTM A529/A529M - Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
15. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
16. ASTM A568/A568M - Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
17. ASTM A572/A572M - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

C. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.
   2. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.

D. Factory Mutual (FM):
   1. FM - Roof Assembly Classifications.

E. Underwriters Laboratories, Inc. (UL):
   1. UL - Fire Resistance Directory.

F. Steel Structures Painting Council (SSPC):
   1. SSPC - Painting Manual.
   2. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
   3. SSPC-Paint 22 - Epoxy Polyamide Paints.
   4. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
   5. SSPC-SP 2 - Hand Tool Cleaning.
   6. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Shop Drawings:
      a. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
      b. Connections.
      c. Cambers and loads.
      d. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
   2. Assurance/Control Submittals:
      a. Erection Procedure: Submit descriptive data to illustrate structural erection procedure including sequence of erection and temporary staying and bracing.
      b. Field Welding Equipment: Submit descriptive data for field welding equipment including type, voltage, and amperage.
      c. Test Reports: Submit the following reports directly to General Services Director or Designee from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
         1) Welding inspection.
         2) Bolted connection inspection.
      d. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
      e. Qualification Documentation: Submit documentation of fabricator and erector experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
   2. Erector:
      a. A company specialized in performing the work of this section with a minimum of 5 years documented experience.
      b. A qualified company that participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE or CSE.
   3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily

passed AWS qualification tests within previous 12 months. If rectification of welders is required, provide without additional cost to Owner.

B. Fabricate structural steel members in accordance with AISC Code of Standard Practice.

C. Perform Work in accordance with AISC Section 10.

D. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in State where Project is located.

E. Survey: Employ Professional Engineer registered in State in which Project is located, experienced in survey work, to establish permanent bench marks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to General Services Director or Designee. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with General Services Director or Designee.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Store steel above ground on platforms, skids, or other supports.

C. Protect steel from corrosion.

D. Store packaged materials in their original, unbroken packages or containers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates and Bars: ASTM A 36.

B. Structural Tubing: ASTM A 500, Grade B.

C. Bolts, Nuts, and Washers: AISC Specification Section 1.4.4.
1. Unfinished Bolts: ASTM A 307.
2. High Strength Bolts: ASTM A 325 or A 490.
3. Anchor Bolts and Nuts: ASTM A 307 Grade A.
4. High Strength Anchor Bolts: ASTM A 490.

D. Welding Materials: AWS D1.1; type required for materials being welded or as indicated on Drawings.

E. Rivets: AISC Specification Section 1.4.3.
1. Steel Structural Rivets: ASTM A 502.

F. Grout: Specified in Section 033000.

G. Shop and Touch-Up Primer: AISC Specification Section 1-24.

2.2 FABRICATION

A. Fabricate structural steel members in accordance with AISC Code Section 6 and AISC Specification.

B. Connections not detailed on Drawings: Engineer by fabricator, which is subject to review.

C. Fabricator's Responsibility:
   1. Errors of detailing, fabrications, and for correct fitting of structural steel members.
   2. Do not splice structural steel members. Members having splice not indicated on Drawings will be rejected.

D. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

E. Fabricate connections for bolt, nut, and washer connectors.

F. Develop required camber for members.

2.3 FINISH

A. Clean, prepare, and shop prime structural steel members in accordance with SSPC - Painting Manual. Do not paint surfaces in contact with concrete, or surfaces specified to be galvanized.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, and high strength bolted.

2.4 SOURCE QUALITY CONTROL AND TESTS

A. Provide shop testing of structural steel sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 PREPARATION

A. Supply items required to be cast into concrete or embedded in masonry with setting diagrams to appropriate Sections.

3.3 ERECTION

A. Erect structural steel in accordance with AISC Code, Section 7, and AISC Specification Section 1.25 except as specified herein.

B. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Structural Engineer.

D. Field weld components indicated on Drawings.

E. Field connect members with threaded fasteners; torque to required resistance.

F. After erection, prime welds, abrasions, and surfaces not shop painted that are to receive finish painting, except surfaces to be in contact with concrete. Use a primer consistent with shop coat.

G. Anchor Bolts: Install anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

H. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of base and bearing plates.
   1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
   2. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to grouting.
   3. Grout solidly between bearing surfaces and bases of plates immediately after erecting member and before additional load is placed on member. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's installation instructions.
   4. Slide bearings: Permanently affixed to member and support, respectively, by welding or bolting as indicated. Align and level member faces to maintain full contact between surfaces before completing installation.

I. High-strength Bolting: Comply with specifications for Structural Joints using ASTM A 325 or A 490 Bolts.

J. Erection Bolts:
   1. Comply with ASTM A 307.
   2. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

K. Touch-up Painting: Immediately after erection, clean exposed field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.4 CONSTRUCTION

A. Site Tolerances:
   1. Maximum Variation From Plumb: 1/4 inch.
   2. Maximum Offset From True Alignment: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Quality Assurance Program:
   1. AISC Code Section 8 and AISC Specification Section 1.26.
   2. AISC Quality Criteria and Inspection Standards, except as specified herein.

C. Welding:
   1. AWS D1.1 Section 6.
   2. Inspectors: AWS Certified in accordance with AWS QCI, Standard for Qualifications and Certification of Welding Inspectors.

END OF SECTION

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel roof deck and accessories.
   2. Framed openings up to 10 inches by 10 inches.
   3. Welding, fasteners, and accessories for attachment of deck.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 051200 - Structural Steel Framing: Support framing for openings larger than 10 inches x 10 inches.
   2. Section 052100 - Steel Joist Framing: Support framing for steel decking.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI):
   1. Specification for the Design of Cold-Formed Steel Structural Members.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 - Specification for Structural Steel, Sheet, Carbon, Cold-Rolled.
   2. ASTM A 653 – Specification for Steel Sheet, Zinc Coated, Galvanized.

C. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.
   2. AWS D1.3 - Structural Welding Code - Sheet Steel.

D. Steel Deck Institute (SDI):
   1. Design Manual for Composite Decks, Form Decks, Roof Decks, (Publication No. 25).
      a. Code of Recommended Standard Practice.
      b. Specifications and Commentary for Steel Roof Deck.
   2. SDI Diaphragm Design Manual 1st Edition.

E. Steel Structures Painting Council (SSPC):
   1. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
   2. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Deck profile characteristics and dimensions, structural properties, and finishes.
   2. Shop Drawings: Indicate deck plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
   3. Assurance/Control Submittals:

a. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
2. Erector: Company specializing in performing the work of this section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to City.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Prevent damage to edges, ends and surfaces.

C. Cut plastic wrap to encourage ventilation. Keep materials dry.

D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel:
1. ASTM A 1008 structural quality; with G60 galvanized coating conforming to ASTM A 653.

B. Bearing Plates and Angles: ASTM A 36 steel.

C. Welding Materials: AWS D1.1.

D. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

E. Touch-Up Primer for Galvanized Surfaces: SSPC 20, Type 1, inorganic.

F. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to decking.

G. Closure Strips, Cover Plates, and related Accessories: Fabricated of metal of same type and finish as deck.

H. Screw Fasteners: Self-drilling, self tapping No. 12 HWH Teks, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720.
1. Substitutions: Permitted

I. Powder Actuated Fasteners: Minimum 0.145 inch diameter knurled hardened steel shank; minimum 0.5625 inch diameter washer; meet SDI design requirements.
   1. ENP2-21-L15, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000, (800) 879-8000.
   2. Substitutions: Permitted.

J. Air Actuated Fasteners: Minimum 0.130 inch diameter knurled hardened steel shank; minimum 0.500 inch diameter steel washer or head; meet SDI design requirements.
   1. X-EDNK22 HSN or X-EDN19 HSN, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000.
   2. K-65056 or SDK-63075, by Pneutek, Inc., Hudson, New Hampshire, (603) 883-1660, (800) 431-8665.
   3. Substitutions: Permitted.

K. Side Lap Fasteners: Self-drilling screws; #10-16 TEKS/1, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720, or acceptable substitute.

2.2 FABRICATION

A. Steel Roof Deck: Minimum gage sheet steel as indicated on Drawings, 1-1/2 inch high, fluted profile to SDI WR; multiple span; lapped joints.

B. Fabricate metal decking in accordance with the SDI Design Manual for Composite Decks, Form Decks, Roof Decks, and AISI, to accommodate maximum working stress of 20,000 psi and maximum span deflection of 1/240.

C. Fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 INSTALLATION

A. Erect metal decking and connect to structure in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks. Coordinate attachment sequence and procedure with placing of units; show on shop drawings.

B. On steel support members provide 1-1/2 inch minimum bearing. On masonry support surfaces provide 3 inch minimum bearing.

C. Align and level deck on supports.

D. Provide welds, fasteners, and side lap connectors of size, spacing, and location as indicated on Drawings.

E. Install Hilti powder actuated fasteners using the DX-450 or DX-750 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.

F. Install Hilti air actuated fasteners using the R4x12 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.

G. Install Pneutek air actuated fasteners using decking system, by Pneutek. Install pins in accordance with manufacturer's recommendations. Pin head shall clamp deck tightly to supporting member without gaps between underside of head and top side of deck. Pin shall not cause excessive dimpling of the deck greater than 1/2 the thickness of the pin head.

H. Powder and air actuated fasteners shall be installed by a tool operator licensed by the pin manufacturer. A representative of the pin manufacturer shall be on site to verify proper installation of fasteners, and shall submit written verification to General Services Director or Designee.

I. Welding: In accordance with AWS D1.1 and D1.3. Provide welding washers when welding 26 gauge or lighter steel deck.

J. Install 6 inch wide sheet steel cover plates where deck changes direction. Spot weld in place 12 inches on center maximum. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

K. Position roof sump pans with flange bearing on top surface of deck. Weld at each deck flute.

L. Immediately after welding deck in place, touch-up welds, burned areas, and surface coating damage with compatible primer paint.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Inspection:
   1. Select 6 random sheets for each type of deck used. Inspect for deck thickness, type, and material.
   2. Inspect 10 percent of deck welds over entire roof area for size and spacing (CWI to perform inspection).
   3. Inspect 10 percent of side lap connectors over entire roof area for type, size, and spacing of side lap connectors.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Load-bearing and metal stud wall and partition framing, with anchorage and bracing.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI)
1. Specification for the Design of Cold-Formed Steel Structural Members .
2. Cold-Formed Steel Design Manual (Latest).

B. American National Standards Institute (ANSI)
1. ANSI A58.1 - Roof, Wind and Snow Loads.

C. American Society for Testing and Materials (ASTM):
1. ASTM A653 - Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A1101- Hot-Rolled Carbon Steel Sheet & Strip, Carbon Hot-Rolled Structural Quality.
3. ASTM A1008- Standard Specification for Structural Steel Sheet, Carbon, Cold-Rolled.
4. ASTM C955 - Standard Specification for Load Bearing Steel Studs, Runners (Track), Bracing, and Bridging for Screw Application of Gypsum Panel Products.

D. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code and D1.3 - Specifications for Welding Sheet Steel in Structures.
2. AWS - Standard Qualification Procedure.

E. Federal Specification.
1. FS TT-P-636C - Rust-Inhibitive Paint.

F. Metal Lath/Steel Framing Association (ML/SFA) - Lightweight Steel Framing Systems Manual, Latest Edition.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.
1. Design shall use the superimposed design loads specified in the Design Criteria section of the Structural General Notes in the Contract Drawings.
2. Design shall be based upon information shown on the drawings and specified herein.
3. Additional Design Criteria - ANSI A58.1 or:

a. Load-bearing live loads:
   1) Load-bearing partitions:
      i. Lateral pressures: 5 psf
   2) Non-load-bearing partitions:
      i. Lateral pressures: 5 psf
   3) Exterior curtain walls:
      i. Wind loads based on wind speeds of 100 MPH.
   4) 4) Maximum allowable deflection with brick veneer:
      i. Calculated on 18 ga. stud capacity alone: 1/600.

4. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.
5. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS Standard Qualification Procedure.
6. Design non-axial load-bearing framing to accommodate 1/2 inch (13 mm) vertical deflection.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. All shop drawings and calculations must bear the seal and signature of an engineer registered in the jurisdiction where project is being constructed.
   2. Product Data:
      a. Manufacturers' literature containing product and installation specifications and details.
   3. Shop Drawings:
      a. Documents illustrating materials, shop coatings, steel thickness, details of fabrication and erection, details of attachment, spacing of fasteners, required accessories and critical installation procedures.
   4. Calculations:
      a. Engineering calculations or data verifying the framing assembly's ability to meet or exceed design requirements as stated here-in and required by local codes, prepared under the supervision of a Professional Engineer.
   5. Assurance/Control Submittals:
      a. Test Reports: Submit the following reports directly to General Services Director or Designee from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
         1) Testing/Inspection reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results. Note inspection findings.
      b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
      c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Pre-Installation Meetings:
   1. Convene a pre-installation meeting one week prior to commencing Work of this Section. Notify the Architect and General Services Director or Designee of the meeting date and time at least 7 days prior.
   2. Require attendance of parties directly affecting Work of this Section.
   3. Review conditions of operations, procedures and coordination with related Work.
   4. Agenda:
      a. Tour, inspect, and discuss conditions of installation of other work including door and window frames and mechanical and electrical work.
      b. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
      c. Review required submittals, both completed and yet to be completed.
      d. Review Drawings.
      e. Review and finalize construction schedule related to cold formed metal framing installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
      f. Review required inspections, testing, certifying, and material usage accounting procedures.
      g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
      h. Review safety precautions relating to operations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings and protect against mechanical damage to units. Store materials on a flat plane. Any damaged materials shall be removed from the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the plans or as required by manufacturer design, if called for. Studs, runners (track), bracing, and bridging shall be manufactured per ASTM Specification C-955.

B. All painted studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A570 or A611, as set forth in Section 1.2 of the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

C. All galvanized studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A653, as set forth in Section 1.2 of the AISI Specification for Design of Cold-Formed Steel Structural Members (latest edition).

D. All painted studs, joists and accessories shall be prime-painted with a rust-inhibitive paint, FS TT-P-636C.

E. All galvanized studs, joists and accessories shall have a minimum G-60 coating.

F. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

G. Framing Accessories:
   1. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
      a. B&D Industries, LLC, Albany, NY (800) 924-4807.
      b. Deitrich, Pittsburgh, PA (800) 873-2443.
      c. The Steel Network, Incorporated., Raleigh, NC (888) 474-4876.
   2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
   3. Interior or Exterior non-axial-load-bearing Wall Head Condition Deflection Accessories:
      a. Deitrich: Double-Deep-Leg Track.
      b. The Steel Network: VertiClip® SLD (interior), SL (exterior).
   4. Exterior non-axial-load-bearing Wall Slab Bypass Deflection Accessories:
      a. B&D: Quick Clip®.
      b. The Steel Network: VertiClip® SLB or SLS Series.

2.2 FABRICATION

A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.

C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted.

D. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 INSTALLATION AND STUDWALLS

A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

B. Stud Walls:
   1. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches on center spacing for nail or power- driven fasteners, or 16 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.
   2. Position studs plumb in runners and space no greater than 16 inches and not more than 2 inches from abutting walls and at each side of openings. Connect studs to upper and lower tracks using self-drilling, screws or welding in accordance with Manufacturer's recommendations such that the connection meets or exceeds the design loads required at that connection.
   3. Brace all studs at mid-height for added strength, stiffness, and fire-stopping.
   4. Construct corners using minimum of three studs. Double studs at door, window, and sidelight jambs. Install intermediate studs above and below openings to match wall stud spacing.
   5. Provide deflection allowance below supported horizontal building framing in ceiling or head track for non-load-bearing framing in a method recommended by stud manufacturer.
      a. Where walls and partitions must close out against the deck for smoke and fire separation provide a top track rigidly attached to vertical studs but free to move vertically in a 14 gauge break-formed deep leg track rigidly attached to deck with slack to accommodate structural live load deflections noted on drawings; or head condition vertical slide clips in coordination with alignment track (20 gage at exterior walls, 25 gage at interior walls).
      b. Where wall or partition studs pass by the structural deck provide vertical slide clips welded or screw attached to the structural support but do not attach rigidly to studs.

3.3 INSTALLATION: PRE-FABRICATED AND PANELIZED CONSTRUCTION

A. Panels shall be designed to resist construction and handling loads as well as service loads.

3.4 INSTALLATION: NON-PANELIZED (STICK-BUILT) MEMBERS

A. Align track accurately at supporting structure and fasten to structure as shown on shop drawings.

B. Track intersections shall butt evenly.

C. Studs shall be plumbed, aligned, and securely attached to flanges or webs of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks.

3.5 INSTALLATION: JOISTS

A. Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.

B. Provide web stiffeners where necessary at reaction points, and at points of concentrated loads, as shown on the shop drawings.

C. Bridging, either strap or solid, shall be provided as shown on the shop drawings.

D. Provide additional joists under parallel partitions where the partition length exceeds 1/2 of the joist span.

E. Provide additional joists around all floor/roof openings which are larger than the joist spacing and as noted on the shop drawings.

F. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

3.6 FASTENINGS AND ATTACHMENTS

A. Anchorage of the tracks to the structure shall be with methods designed for the specific application of sheet to that surface. Size, penetration, type and spacing shall be determined by design.

B. Welds shall conform to the requirements of AWS D1.1, AWS D1.3, and AISI Manual Section 4.2. Welds may be butt, fillet, spot, or groove type, the appropriateness of which shall be determined by, and within the design calculations. All welds shall be touched-up using zinc rich paint to galvanized members, and paint similar to that used by the manufacturer for painted members.

C. Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.

D. Wire tying in structural applications is not permitted.

3.7 CONSTRUCTION

A. Site Tolerances:
   1. Vertical alignment (plumbness) of studs shall be within 1/960th (1/8 inch in 10.0 inches) of the span.
   2. Horizontal alignment (levelness) of walls shall be within 1/960th (1/8 inch in 10.0 inches) of their respective lengths.
   3. Spacing of studs shall not be more than ±1/8 inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
   4. Squareness - Prefabricated panels shall not be more than 1/8 inch out of square within the length of that panel.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

   1. Inspect all work in order to assure strict conformance to the shop drawings at all phases of construction.
   2. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement, reinforcement, etc.
   3. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up as specified herein.
   4. General Inspection of structure shall be completed prior to applying loads to those members.
   5. Inspections where and as required by local codes shall be controlled inspections.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous framing and supports.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. Specifications for the Design, Fabrication and Erection of Structural Steel for Building

B. American National Standards Institute (ANSI):
   1. ANSI A14.3, "Ladders, Fixed, Safety Requirements."

C. American Society for Testing and Materials (ASTM):
   1. ASTM A36, "Structural Steel."
   2. ASTM A53, "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."
   3. ASTM A123, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
   4. ASTM A153, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
   5. ASTM A307, "Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."
   6. ASTM A500, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes."
   7. ASTM A568, "Specification for General Requirements for Steel Sheet, Carbon, and High-Strength, Low Alloy Hot-Rolled and Cold Rolled."
   8. ASTM A627, "Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications.
   9. ASTM A780, "Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."
   10. ASTM B221, "Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tube."

D. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.

E. Steel Structures Painting Council Specification (SSPC):
   1. Steel Structures Painting Manual.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data:
      a. Submit complete descriptive data for all stock items.
   2. Shop Drawings:

a. Prepare Shop Drawings under seal of professional structural engineer registered in state where Project is located for products requiring structural engineering.
b. Include profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories, erection drawings, elevations, welded connections using standard AWS welding symbol with net weld lengths.
c. Take field measurements prior to preparation of shop drawings and fabrication when possible. Allow for trimming and fitting whenever taking of field measurements before fabrication might delay construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel plates, angles, and other structural shapes shall conform to ASTM A36.

B. Steel pipe shall conform to ASTM A53, Grade B, Schedule 40.

C. Galvanized steel pipe and tube shall conform to ASTM A53.

D. Steel Tubing shall conform to ASTM A500.

E. Sheet Steel, Galvanized: ASTM A446.

F. Sheet and Strip Steel, Hot Rolled: ASTM A568.

G. Extruded Aluminum: ASTM B221.

H. Anchors and Fasteners for Aluminum: Stainless steel.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Anchors
1. Threaded Type Concrete Inserts: Galvanized malleable iron or cast steel capable of receiving 3/4 inch diameter machine bolts.
2. Slotted Type Concrete Inserts: Welded box type fabricated with minimum 1/8 inch thick galvanized pressed steel plate with slot to receive 3/4 inch diameter square head bolt and knockout cover.
3. Expansion Shield for Masonry Anchorage: FS FF-2-325.
4. Toggle Bolts: FS FF-B-588.

K. Fasteners
1. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
2. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.
3. Bolts, Round Head: ANSI B-18.5
4. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
5. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-84.

L. Primers:

1. Primer for Painting: One of following:
   a. Tnemec, Kansas City, MO, (816) 474-3400: No. 99 red primer.
   b. Chessman-Elliot Company: Ceco No. 15 Primox.
   c. Rowe Products, Inc.: No. 7-C-19.
   d. Section 016000 – Product Substitutions. Substitutions: Permitted.
2. Touch-Up Primer for Galvanized Surfaces: FS TT-P-641.

2.2 FABRICATION

A. Fabricate steel items according to approved shop drawings and to applicable portions of AISC Specifications. Conceal welds where possible; grind exposed welds smooth and flush with adjacent finished surface. Ease exposed edges to small uniform radius.

B. Pre-assemble products in shop to greatest extent possible. Disassemble units to extent necessary for shipping and handling. Clearly mark units for re-assemble and installation.

C. For exposed to view fabrications, use materials which are smooth and free of surface blemishes including pitting, seams marks, roller marks, roller trade names and roughness. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.

D. Fabricate items with joints tightly fitted and secured.

E. Fit and shop assemble in largest practical sections for delivery to Project site.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.

G. Make exposed joints butt tight, flush and hairline.

H. Fabricate anchorage and related components of same material and finish as metal fabrication, unless indicated otherwise.

2.3 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

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

2.4 LOOSE STEEL LINTELS

C. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

D. Weld adjoining members together to form a single unit where indicated.

E. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.

F. Galvanize all surfaces of loose steel lintels located in exterior walls.

2.4 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inch x 8 inches long.

2.5 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

B. Galvanize miscellaneous framing and supports in the following locations:
   1. Exterior locations.

2.6 FINISHES, GENERAL

A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.7 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
   1. ASTM A153 for galvanizing iron and steel hardware.
   2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP3 “Power Tool Cleaning”:

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 “Paint Application Specification No. 1” for shop painting.

2.8 SHOP PAINTING AND PROTECTIVE COATING

A. Conform to Steel Structures Painting Council Specification 15-68T, Type 1, including preparation for painting.

B. Hot-Dip galvanizing and zinc coatings applied on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips shall comply with ASTM Specification A123. Galvanized surfaces for which a shop coat of paint is specified shall be chemically treated to provide a bond for the paint. Except for bolts and nuts, all galvanizing shall be done after fabrication.

C. Clean surfaces of rust, scale, grease and foreign matter in accordance with SSPC SP-1 solvent cleaning, prior to finishing. Prepare surfaces for painting in accordance with SSPC-SP2 Hand Tool Cleaning, SSPC-SP3 Power Tool Cleaning or SSPC SP-7 Brush Off Blast Cleaning.

D. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

E. Prime paint items scheduled with one coat.

F. Protect aluminum surfaces in contact with steel with zinc chromate primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.4 ADJUSTING AND CLEANING

F. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

G. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

SECTION 055213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe handrails.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 099100 - Painting: Field paint finish.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 53 - Specification for Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
   2. ASTM 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM E 894 - Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
   4. ASTM E 935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
   5. ASTM E 985 - Permanent Metal Railing Systems and Rails for Buildings.

B. Steel Structures Painting council (SSPC):
   1. SSPC Paint 15 - Type 1, Red Oxide.
   2. SSPC Paint 20 - Type 1 Inorganic Zinc Rich.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.
   2. Railing assembly, wall rails, and attachments to comply with local code requirements and to resist minimum lateral force according to IBC or more stringent local building code at any point without damage or permanent set.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   2. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe: ASTM A 53, Grade B Schedule 80.

B. Rails and Posts: Steel pipe; with welded joints, of sizes and shapes as indicated on Drawings.

C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.

D. Mounting on Concrete Floor: Steel sleeves, sized to receive railing post with 1/4 inch clearance.

E. Mounting on Masonry or Concrete Walls: Brackets with anchors for building in masonry.

F. Mounting on Stud Walls: Brackets and anchor plates, predrilled to receive bolts.

G. Splice Connectors: Steel threaded collars.

2.2 FABRICATION

A. Fit and shop assemble sections in largest practical sizes, for delivery to site and installation.

B. Supply components required for secure anchorage of handrails and railings.

C. Fully weld joints. Grind exposed welds smooth and flush with adjacent surfaces.

D. Wake exposed joint butt tight, flush, and hairline.

E. Accurately form components required for anchorage of railings to each other and to building structure.

F. Prime railings which will be exposed.

2.3 FINISH

A. At Building Exterior:
   1. Galvanizing: ASTM A123; provide minimum 2.0 ounces per square foot.
   2. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic zinc rich.

B. At Building Interior: SSPC 15, Type 1, red oxide.

C. Field paint as specified in Section 099100.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify field dimensions prior to shop fabrication.

C. Report in writing to the General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Furnish items required to be cast into concrete, embedded in masonry, placed in partitions with setting templates, to appropriate Sections.

3.3 INSTALLATION

A. Install in accordance with manufacturer's published instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Anchor railings to structure with anchors in conformance with ASTM E 985.

D. Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.

E. Insert railing posts in sleeves and pack sleeves with non-shrink grout.

3.4 CONSTRUCTION

A. Site Tolerances:
   1. Maximum Variation From Plumb: 1/4 inch.
   2. Maximum Offset From True Alignment: 1/4 inch.
   3. Maximum Out-of-Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Inspect railings and handrail installation and attachment to structure.

C. Inspect paint finish applied to surfaces.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concealed blocking behind wall mounted items.
2. Sheathing material.
3. Wood treatment.
4. Building paper.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
1. Section 061753 - Shop-Fabricated Wood Trusses: Roof trusses.

1.2 REFERENCES

A. American Lumber Standards Committee (ALSC):
1. Softwood Lumber Standards.

B. American Plywood Association (APA):
1. Grades and Standards.

C. American Society for Testing and Materials (ASTM):
1. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
2. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

D. American Wood Preservers Association(AWPA):
1. AWPA - C1 - All Timber Products - Preservative Treatment by Pressure Process.
2. AWPA - C15 - Wood for Commercial-Residential Construction Preservative Treatment by Pressure Processes.
3. AWPA - C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
4. AWPA - C27 - Plywood - Fire-Retardant Treatment by Pressure Processes.
5. AWPA - P5 - Waterborne Preservatives.

E. Underwriters' Laboratories, Inc. (UL):
1. UL FR S - Fire Rated Treated Wood with Flame Spread and Smoke Developed Ratings of 25 or less in accordance with ASTM E84.
2. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Assurance/Control Submittals:
a. Certificates:

1) Pressure Treated Wood: Certification from treating plant stating chemicals and process used and net amount of preservative retained are in conformance with specified standards.
2) Preservative Treated Wood: Certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.
3) Fire-Retardant Treated Wood: Certification from treating plant stating that fire-retardant treatment materials comply with governing code, ordinances and requirements of local authority having jurisdiction, and treatment will not bleed through finished surfaces.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:
1. Lumber Grading Agency: Certified by ALSC.
2. Plywood Grading Agency: Certified by APA.

B. Regulatory Requirements: Conform to applicable codes for fire-retardant treatment of wood surfaces for flame/smoke ratings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
1. Inspect wood materials for conformance to specified grades, species, and treatment at time of delivery to Project Site.
2. Reject and return unsatisfactory wood materials.

B. Provide facilities for handling and storage of materials to prevent damage to edges, ends and surfaces.

C. Keep materials dry. Stack materials off ground minimum 12 inches or, if on concrete slab-on-grade, minimum 1-1/2 inches, fully protected from weather. Provide for air circulation within and around stacks and under temporary coverings.

D. For materials pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Environmental Impact:
1. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
2. Wood pressure treatment products: Products containing chromium will not be permitted. Products containing arsenic will not be permitted.
3. Use exterior plywood only. Interior plywood is not permitted.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber, finished 4 sides, 15 percent maximum moisture content. Each piece of lumber to be factory marked with type, grade, mill and grading agency.
1. Light framing: Construction grade Douglas fir or southern pine, appearance grade where exposed.

2. Structural framing and timbers: No. 2 grade Douglas Fir, Southern Pine, or Spruce, appearance grade where exposed.
3. Boards: Construction grade.

2.2 NAILERS, BLOCKING, FURRING AND SLEEPERS

A. Wood for nailers, blocking, furring and sleepers: Construction grade, finished 4 sides, 15 percent maximum moisture content. Pressure preservative treat items in contact with roofing, flashing, waterproofing, masonry, concrete or the ground.

2.3 SHEATHING MATERIALS

A. Plywood, APA rated for use and exposure:
1. Exterior wall sheathing: APA C-D rated 32/16 Sheathing, 1/2 inch minimal thickness, exterior type.
2. Roof sheathing: APA rated 48/24 sheathing, 5/8 inch minimum thickness, exterior type.
3. Backing panels: APA C-D plugged, 3/4 inch thick, exterior type.
4. Security Ceiling: APA rated 48/24 sheathing, 5/8 inch minimum thickness, tongue and groove, exterior type.

2.4 BUILDING PAPER

A. Asphalt saturated felt, non-perforated.

2.5 FASTENERS

A. Fasteners: Provide manufacturers recommended power tools for each type of fastener.
1. Bolts, Nuts, Washers, Lag Screws, and Wood Screws: ASTM A307, Medium carbon steel; size and type to suit application; galvanized for treated wood; plain finish for other interior locations, of size and type to suit application, unless otherwise noted.
2. Expansion Shield Fasteners: For anchorage of non-structural items to solid masonry and concrete.
3. Powder or Pneumatically Activated Fasteners: For anchorage of non-structural items to steel.
4. Fasteners for Wood and Plywood (over 1/2 inch) to Light Gage Metal Framing and Metal Deck (up to 1/8 inch thick):
   a. Hilti PWH #3 with wings.
   b. ITW TEKS/4 with wings.
   c. Substitutions: Permitted
5. Fasteners for Wood and Plywood (up to 2 inches thick) to Metal (from 1/8 inch to 1/4 inch thick):
   a. Hilti PFH #4 with wings.
   b. ITW TEKS/4 with wings.
   c. Substitutions: Permitted

6. Fasteners for Non-Structural Wood Members to Masonry: 1/4 inch diameter x 3-1/4 inch with phillips flat head.
   a. Tapcon masonry anchors, by ITW Buildex.
   b. Kwik-Con II fastener, by Hilti.
   c. Substitutions: Permitted
7. Fasteners for preservative treated lumber must be hot dipped galvanized, type 304 or 316 stainless steel, or zinc-polymer coated.

2.6 WOOD TREATMENT

A. Preservative Pressure Treated Lumber, Alkaline Copper Quat (ACQ): Type B, Ammoniacal Copper Quat
   1. Manufacturers:
      a. Chemical Specialties, Incorporated, Charlotte, NC (800) 421-8661.
      b. Arch Wood Protection, Inc., Smyrna, GA (770) 801-6600
      c. Osmose Inc., Griffin, GA, (800) 241-0240
   2. Products:
      a. CSI: “Preserve”.
      b. Arch Wood: “Natural Select”
      c. Osmose: “Nature Wood”
   3. Impregnate lumber with preservative treatment conforming to AWPA Standard C1 and P5. Apply the preservative in a closed cylinder by pressure process in accordance with AWPA Standard C15.
   4. Retention of preservative:
      a. Moderate service conditions (weather exposure): 0.25 pounds per cubic foot (oxide basis).
      b. Severe conditions (constant contact with ground or water): 0.40 pounds per cubic foot (oxide basis).
   5. Remove excess moisture where shrinkage is a serious fault or where treated lumber will be in contact with plaster, or stucco, and where water-borne treated lumber is to be painted or stained.
   6. Lumber shall be dried to 15 to 19 percent moisture content after treatment, and material to be painted or stained shall have knots and pitch streaks sealed as with untreated wood.
   7. Liberally brush freshly cut surfaces, bolt holes and machined areas with the same preservative in accordance with AWPA Standard M4.
   8. Treatment material shall provide protection against termites and fungal decay and shall be registered for use as a wood preservative by the U. S. Environmental Protection Agency.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Chemical Specialties, Incorporated, Charlotte, NC (800) 421-8661.
      b. Hickson Corporation, Smyrna, GA: (770) 801-6600.
      c. Hoover Treated Wood Products, Incorporated, Thomson, GA: (800) 832-9663.
   2. Products:
      a. CSI: “D-Blaze”.
      b. Hickson: “Dricon”.
      c. Hoover: “Pyro-Guard”.
   3. Lumber and plywood shall be treated as follows:
      a. Each piece of treated material shall bear the UL FR-S rating (flamespread and smoke developed less than 25) indicating compliance with an extended 30 minute tunnel test in accordance with ASTM E84 or UL 723.
      b. After treatment, all lumber shall be dried to an average moisture content of 19 percent or less.
      c. After treatment, all plywood, shall be dried to an average moisture content of 15 percent or less.
      d. All treated material shall meet interior Type A requirements in AWPA standard C-20 for lumber and C-27 for plywood.
      e. Chemicals used to treat material shall be free of halogens, sulfates and formaldehyde.

C. Wood Requiring Treatment:
   1. Lumber, Preservative Treated: Nailers, blocking, stripping, and similar items in conjunction with roofing, flashing, and other construction. Sills, blocking, furring, stripping, and similar items in contact with masonry or concrete.
   2. Lumber, Fire Retardant Treated: Interior framing, furring, blocking, nailers, and miscellaneous exposed wood. Do not treat furring in contact with masonry or concrete.
   3. Interior Plywood, Fire Retardant Treated: Exterior type plywood backing for electrical and telephone equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify that spacing, direction and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailing strips.

C. Report in writing to the General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION - PLYWOOD

A. Secure roof sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing.

B. Use sheathing clips between sheets between roof framing members or provide solid edge blocking between sheets.

C. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

D. Install plywood in combination single and two span continuous.

E. Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 12 inches (25 cm) beyond size of electrical panel.

3.3 INSTALLATION - AIR INFILTRATION SEAL

A. Place material horizontally over wall sheathing, minimum 2 inch (5 cm) overlap and 6 inch (15 cm) endlap; weather lap edges and ends; fasten to sheathing with corrosion resistant fasteners.

3.4 SITE TREATMENT OF WOOD MATERIALS

A. Apply preservative treatment in accordance with manufacturer's published instructions.

B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.5 CONSTRUCTION

A. Site Tolerances:

1. Framing Members: 1/4 inch from true position, maximum.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

B. Framing Inspection:
   1. Inspect wood framing installation and connections at completion of each phase of wood construction for correct installation, nailing, connections, and fasteners.
   2. Inspect and verify that types and spacing of fasteners are installed in locations specified or indicated on Drawings.
   3. Inspect types, locations, and fasteners for structural metal framing connectors.
   4. Inspect types, locations, and connections of hold-down anchors.
   5. Inspect wood to steel beam connections.

END OF SECTION

SECTION 071113

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cold applied asphalt bitumen dampproofing.
   2. Application on masonry or concrete surfaces material.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM D 41 - Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   2. ASTM D 1227 - Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Provide properties of primer, bitumen, and mastics.
   2. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
      b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until membrane has cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
   1. ChemRex Incorporated; Shakopee, MN. (800) 433-9517.
   2. Karnak Chemical Corporation, Clark, NJ. (800) 526-4236.
   3. W.R. Meadows Incorporated, Hampshire, IL. (800) 342-5976.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COLD-APPLIED ASPHALT EMULSION DAMPPROOFING

A. Primer: ASTM D 41 asphalt, compatible with substrate.

B. Trowel Grade: Emulsified asphalt mastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
   1. ChemRex: Hydrocide 700 Mastic.
   2. Karnak: 920 Fibrated (Trowel Grade) Dampproofing.
   3. Meadows: Sealmastic Type 3 - Trowel Grade.

C. Spray Grade: Emulsified asphalt, prepared with mineral-colloid emulsifying agents without fibrous reinforcement, complying with ASTM 1227, Type III.
   1. ChemRex: Hydrocide 600.
   2. Karnak: 100 non-Fibrated Emulsion Coating.
   3. Meadows: Sealmastic Type I - Spray Grade.

D. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
   1. ChemRex: Hydrocide 700B Semimastic.
   2. Karnak: 220 AF Fibrated Dampproofing.
   3. Meadows: Sealmastic Type 2 - Brush-On or Spray Grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing.
   2. Verify items which penetrate surfaces to receive dampproofing are securely installed.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean a prepare surfaces to receive dampproofing in accordance with manufacturer's published instructions.

C. Apply mastic to seal penetrations, small cracks or minor honeycomb in substrate.

3.3 INSTALLATION

A. Prime surfaces in accordance with manufacturer's published instructions.

B. Trowel Grade: Trowel apply at minimum rate of 7 gallons per 100 square feet to produce a minimum dry film thickness of 60 mills.

C. Spray Grade: Spray apply at rate of 1.5 to 2.5 gallons per 100 square feet, depending on substrate texture, to produce a minimum dry-film thickness of 15 mils. Apply in two coats, if necessary, to obtain required thickness. Allow first coat to completely dry before application of second coat.

D. Semimastic: Brush or spray apply at a rate of 5 gallons to produce minimum dry film thickness of 30 mils.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Inspect dampproofing application and test for minimum dry film thickness specified.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Thermal batt insulation for exterior walls.

2. Extruded polystyrene board at horizontal waterproofing.

3. Continuous insulation at exterior walls.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 05 3100 - Steel Decking.

3. Section 07 2719 –Plastic Sheet Air Barriers.

4. Section 09 2216 - Non-Structural Metal Framing.

5. Section 09 2423 – Cement Plaster and Metal Lath.

1.02 SUBMITTALS

A. Product Data:

1. Material List: Provide a list of materials for installation under this section.

2. Provide manufacturer's printed Product Data for each type insulation and accessory.

B. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

C. Certification: Provide certification that insulation materials conform to requirements of CBC Chapter 26.

D. Recycled Content: Provide certification that insulation materials contain a minimum 30 percent recycled materials.

1.03 QUALITY ASSURANCE

A. Surface Burning Characteristics: Flame spread rating shall not exceed 25 and smoke density shall not exceed 50 when tested in accordance with ASTM E84.

B. Combustion Characteristics: Rated as non-combustible when tested in accordance with ASTM E136.

C. Comply with following as a minimum requirement:

1. ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.

2. ASTM C553: Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

3. ASTM C578: Specification for Rigid, Cellular Polystyrene Thermal Insulation.

4. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

5. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

6. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.

7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site and store in a safe, dry place, with labels intact and legible at time of installation.

B. Protect building insulation materials from damage.

1.05 PROJECT CONDITIONS

A. Avoid exposure to humidity and moisture. Protect from exposure to sunlight.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Owens Corning.

B. Johns Manville.

C. CertainTeed Corporation.

D. The DOW Chemical Company.

E. DiversiFoam Products.

F. Equal.

2.02 MATERIALS

A. General:

1. Provide Unfaced, friction-fit batt insulation where both sides of installation are enclosed.

2. Provide batt insulation with integral vapor barrier when one side of installation will be unenclosed.

3. Provide batt insulation with integral vapor barrier where at least one side of installation will be exposed to high humidity, such as showers.

4. Recycled content shall be a minimum of 30 percent.

B. Mineral Fiber Batt Insulation:

1. Unfaced Mineral Fiber Batt Insulation: Provide friction-fit, unfaced mineral fiber batts. Insulation shall consist of mineral fibers, glass or slag, and thermosetting resins complying with ASTM C665, Type I.

2. Faced Mineral Fiber Batt Insulation: Provide mineral fiber batts with vapor barrier consisting of mineral fibers, glass or slag, and thermosetting resins complying with ASTM C665, Type III, Class A, with vapor-retardant membrane facing.

3. Fasteners for Attaching Insulation to Wood Framing:

a. For faced batt insulation provide one of following types of staples: Stainless steel, monel, or copper-coated steel, size as required by manufacturer or applicable code.

b. For unfaced batt insulation provide 18 gage, minimum, galvanized steel wire where required to maintain proper insulation placement.

4. Fasteners for Attaching Insulation to Underside of Metal Roof Decks:

a. Spindle Anchors: Stic-Klip Mfg. Co., Type A or B as required, with Type S adhesive; Miracle Adhesives Corp. "Miracle StukUps" with Type HT994 adhesive; or Goodloe E. Moore Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable; or equal. Provide adhesives of correct type for substrates and type of anchor.

b. String Wires: Minimum 18 gage galvanized steel wire.

C. Extruded-Polystyrene (XPS) Board Insulation: ASTM C578, Type X, thickness as indicated on drawings.

1. Manufacturers:

a. DiversiFoam Products, Certifoam.

b. Dow Chemical Company, Thermax.

c. Owens Corning, Foamular.

d. Equal.

2. Physical Properties:

a. Density, ASTM D1622: Not less than 1.35 pounds per cubic foot.

b. Surface Burning Characteristics, ASTM E84: Flame spread less than 25, smoke developed no greater than 50.

c. Compressive Strength, ASTM D1621: 25 psi minimum.

d. Thermal Resistance, ASTM C1363: R 5 minimum per inch of thickness.

e. Water Vapor Transmission, ASTM E96: Less than 0.03 perms.

f. Water Absorption by Volume, ASTM C209: Maximum 0.10 percent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Work to verify suitability to receive insulation. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Fit batt insulation, of R-value indicated on Drawings, snugly between framing members.

2. Maintain total insulation integrity over entire area to be insulated, including areas between closely spaced members.

3. Extend full thickness insulation over entire area to be insulated. Furnish manufacturer's recommended clips to tightly fit batts at joints.

4. Cut and fit batt insulation tightly around pipes, conduits and penetrations.

5. Do not compress batt insulation in excess of 10 percent (R-19 may be installed in 2 by 6 stud walls).

6. Prevent batt insulation from sagging during and after installation by installing adequate wire.

7. Metal door and window frames in acoustically insulated walls shall be filled with insulation, unless otherwise indicated.

8. Where vapor barrier is provided, install with vapor barrier facing room.

a. Batts in Metal Framing: Provide friction-fit batts tightly fitted to stud webs and to metal furring.

b. Batts under Metal Roof Decks where underside of insulation will be exposed install foil-faced flanged-type insulation batts and staple flanges together at

maximum 4-inch centers and seal joints at abutting vertical surfaces with a pressure-sensitive plastic tape. Where underside of insulation will be inaccessible, install secure with spindle anchors. Provide 18 gage galvanized string wires under batts wherever necessary to prevent sagging. Stretch wire taut.

c. Batts in Horizontal or Sloped Applications: Provide tightly stretched string wires along center of horizontal or sloping batts where support spacing exceed 16 inch on centers.

9. Install polystyrene board as required by Section 07 1326.

B. Continuous Insulation:

1. Continuous insulation shall be installed in accordance to manufacturer instructions. Fasten the insulation board to the exterior face of the steel stud wall framing using preassembled screw/stress plate fasteners, of type and length as recommended by the manufacturer. Fastener pacing shall be 12” on center at the board perimeter and 16” on center in the field of the board.

2. Bottom row of insulation panels shall be mounted on foundation casing “J” mold, refer to Section 09 2423, Cement Plaster and Metal Lath. Fasten insulation boards with corrosion resistant fasteners through sheathing into studs. Use 3/8 inch head roofing nails for wood studs, and self-drilling tapping screws for metal studs, or to “Z” channels, as applicable. Fastener penetration into studs shall be not less than 3/4 inch.

3. Stagger vertical joints at least one stud from adjacent courses.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 07 2200

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof and non-tapered polyisocyanurate roof insulation.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 07 6000 - Flashing and Sheet Metal.

1.02 REGULATORY REQUIREMENTS

A. Comply with requirements of the City of Torrance and authorities having jurisdiction over the Work.

1.03 SUBMITTALS

A. Shop Drawings: Submit roof plans and details. Include roof dimensions, drain and scupper locations, gutter locations, and the layout of insulation boards. Provide details indicating components, attachment and insulation thickness. Provide calculations indicating the average R-value for the system. Indicate drainage patterns and slopes required.

B. Product Data: Submit manufacturer’s data substantiating the insulation complies with specified requirements.

C. Installation Instructions: Submit manufacturer’s installation instructions.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ASTM C 1289 - Faced Rigid Cell Polyisocyanurate Thermal Insulation Board; Type II Class 1 Grade 2.

2. Provide systems complying with requirements for FM Class 1.

3. Provide systems complying with requirements for UL Class A.

4. Achieve a minimum thermal resistance value of R-7 for re-roofing projects, unless noted otherwise.

5. UL 2818 Green Guard Gold certification. Gold Standard for Chemical Emissions for Building Materials.

B. Installer Qualifications: Minimum five years experience installing specified type of insulation under roofing systems, and certified by the insulation manufacturer to install the Work of this section.

C. Pre-installation Meetings: In accordance with related Division 01 sections, conduct a pre-installation meeting on the Project site.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original sealed and labeled containers.

B. Avoid exposure to sunlight and the elements.

C. Handle materials in a manner to avoid damage or contamination with moisture or foreign matter.

1.06 PROJECT CONDITIONS

A. Environmental requirements:

1. Install products in strict accordance with manufacturer's recommendations.

2. Do not install any materials when water in any form is present on the deck or materials are wet. Do not install any materials if precipitation is forecast and partially completed Work will be left unprotected.

3. Do not install the Work of this section if the temperature of the roof deck is below 40 degrees F.

PART 2 - PRODUCTS

2.01 GENERAL

A. Insulation: Rigid polyisocyanurate foam insulation, with specially formulated organic/inorganic facers as manufactured by:

1. Dyplast Products.
2. Celotex Insulation.
3. GAFTEMP.
4. Sarnatherm (Atlas ACII).
5. Equal.

2.02 DESCRIPTION

A. Tapered Roof insulation shall provide minimum per foot slope and provide minimum insulation values as indicated on drawings.

B. Roof and Deck insulation shall consist of polyisocyanurate foam panels, chemically bonded during the foaming process to special organic/inorganic facers on the top and bottom surfaces, and shall conform to the following:

PROPERTIES	**TEST METHOD**	**VALUE**
Compressive Strength	ASTM D 1621	20PSI min.

Dimensional Stability (Thermal and Humid Aging)	ASTM D 2126 (-4 degrees F, amb RH) (158 degrees F, 97 percent RH) (200 degrees F, ambient RH)	 Less than 2 percent linear change Less than 2 percent Linear change Less than 2 percent linear change
Flexural Strength (Modulus of Rupture) (Break load)	ASTM C 203	40 PSI min. 17 PSI min.
Tensile Strength (Perpendicular to surface)	ASTM C 203	500 PSF min.
Water Absorption	ASTM C 209	
Water Vapor Transmission	ASTM E 96	
Core Foam Flame Spread	ASTM E 84	

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify suitability of substrates to receive the Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify suitability of related Work such as the following:

1. Roof drains and scuppers are properly installed.

2. Roof curbs, nailers, equipment supports, vents, and other items penetrating the roof are of the proper height, properly prepared and fastened to the substrate.

3. Concrete surface are sufficiently dry, free from extremes in pH, properly primed and free of fines, edges, or voids.

3.02 INSULATION APPLICATION

A. General:

1. Install the Roof and Deck insulation in accordance with the manufacturer's recommendations and to provide the R values indicated. Butt the panels snugly together.

2. Start boards from either the roof drain or the high point depending on the insulation system. Stencil direction of slope on each board. Stagger joints of underlayment boards from insulation boards.

3. Cut valleys and hips. Field cut crickets from insulation boards. Install valleys, hips, and crickets as required for R values and drainage.

B. Roofing Systems: Fasten insulation with a method recommended by the manufacturer. Method of attachment shall provide a minimum FM I-90 Wind Uplift Rating.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07 2600

VAPOR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vapor barrier and accessories for installation under concrete slabs.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 3000: Cast-in-Place Concrete.

3. Division 09: Finishes; flooring sections.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

B. ASTM International (ASTM):

1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

2. ASTM D1709 - Standard Test Methods of Impact Resistance of Plastic Film by the Free-Falling Dart Method.

3. ASTM E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs.

4. ASTM E1643 - Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

5. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions for vapor barrier and accessories.

B. Samples:

1. 12 inch by 12 inch vapor barrier samples.

2. Pressure-Sensitive Tape: 12 inch long sample.

C. Test Reports: Conducted by nationally recognized independent testing agency indicating conformance with specified performance requirements.

1.04 QUALITY ASSURANCE

A. ASTM tests referenced in this Section shall be performed on a single production roll per ASTM E1745 Section 8.1. Submit third party documentation certifying this requirement.

B. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference to review the progress of construction activities and preparations for the installation of vapor barrier.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging with labels intact.

C. Store materials in a clean and dry area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Multi-layer plastic extrusion manufactured with high grade prime, virgin, polyolefin resins. Thickness shall be 15 mils minimum.

1. Stego Wrap by Stego Industries LLC.

2. Perminator by W.R. Meadows.

3. Ecoshield-E by Epro.

4. Husky Yellow Guard by Poly-America.

5. Equal.

B. Physical Properties:

1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Class Rating per ASTM E1745: Class A.

3. Puncture resistance per ASTM D1709: 2200 g or higher.

4. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

C. Accessories: Provide manufacturer recommended accessories for seams, penetrations and perimeter edges, including tapes, mastics, termination for a complete vapor barrier installation per ASTM E1643.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsoil and notify General Services Director or Designee of deficiencies detrimental to proper vapor barrier installation; do not proceed until corrected.

3.02 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643 and manufacturer's instructions.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise, where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself using manufacturer ASTM E1643 compliant accessory designed to adhere to concrete. Seam tape shall not be used for sealing the vapor barrier to the foundation wall, grade beam or slab.

3. Overlap joints 6 inches and seal with manufacturer's seam tape.

4. Seal vapor barrier penetrations per manufacturer's instructions.

5. Avoid the use of non-permanent stakes driven through the vapor barrier.

B. Prior to concrete placement inspect vapor barrier for damage. Clean damaged areas and with vapor barrier material cut a minimum 6 inches larger than damaged area on all sides. Seal to main vapor barrier with continuous seam tape.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 07 2719

PLASTIC SHEET AIR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Mechanically attached permeable flexible plastic sheet air barriers.

2. Flexible flashing of openings, penetrations, joints, and terminations of exterior walls and taping of seams.

B. Related Requirements:

1. Section 05 4100 – Structural Metal Stud Framing.

2. Section 07 6000 – Flashing and Sheet Metal.

3. Section 07 9200 – Joint Sealants.

4. Section 08 511 3- Aluminum Windows.

5. Section 09 2423 – Cement Plaster and Metal Lath.

1.02 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E1677 - Standard Specification for an Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.

3. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials.

B. International Code Council (ICC):

1. ICC-ES Evaluation Reports.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each material and component proposed for installation.

B. Shop Drawings: Dimensioned plans and elevations indicating:

1. Complete information as to size and location of openings, sleeves, conduits, ducts, boxes, inserts, attachments, and structural interferences.

2. Layout of air barrier showing sheet lapping, cutting, flashing and taping, with references to enlarged details.

C. Installation Instructions: Submit detailed manufacturer's installation instructions.

D. Material Samples: Submit minimum 8-1/2-inch by 11-inch samples of air barrier, and 12 inch long flashing.

E. Test Reports: Submit Test Reports showing performance characteristics equaling or exceeding those specified.

F. Evaluation Reports: Submit ICC-ES Evaluation Report demonstrating conformance of plastic sheet air barrier to CBC 1404.2, for use as water-resistive barrier.

G. Qualification Statements:

1. Installer: Statement from plastic sheet air barrier manufacturer indicating installer is approved, certified, or has been trained for the installation of their products.

1.04 QUALITY ASSURANCE

A. Manufacturer:

1. Plastic sheet air barrier components and accessories shall be from a single source.

2. Manufacturer shall have a minimum of five years of continued experience in the manufacture of the specified products.

B. Installer:

1. Minimum five years in the installation of air/weather barriers.

2. Trained or certified by manufacturer for the installation of their products.

C. Mock-up: Refer to Section 09 2423, Cement Plaster and Metal Lath.

D. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference to review the progress of construction activities related to the installation of plastic sheet air barrier. In addition to the conference attendees listed, plastic sheet air barrier installer and manufacturer technical representative shall attend pre-installation conference.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in undamaged and original packaging.

B. Store materials in a clean, dry, protected location and within temperature range required by plastic sheet air barrier manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with Manufacturer's recommendations.

1.06 WARRANTY

A. Provide a ten year manufacturer's standard material warranty for replacement of plastic sheet air barriers that fail due to material defects.

B. Installation Warranty: Provide a two year installation warranty for the plastic sheet air barrier, including accessories, against loss of water-tight seal and loss of attachment.

C. Warranty shall start on the day of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturer and Products:

1. DuPont (E. I. du Pont de Nemours and Company): Tyvek CommercialWrap.

2. Polymer Group Inc., TyparMetroWrap.

3. Equal.

B. Properties:

1. Plastic sheet air barrier shall be Type I in accordance to ASTM E1677.

2. Air Permeance: shall not exceed 0.004 cfm/ft^2, under a pressure differential of 0.3 in w.g. (1.57 psf) (0.02 L/m^2 at 75 Pa), when tested in accordance with ASTM E2178.

3. Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance to ASTM E84.

2.02 MISCELLANEOUS MATERIALS

A. Flashing: Self-adhesive butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

1. DuPont (E. I. du Pont de Nemours and Company); FlexWrap and StraightFlash.

2. Polymer Group Inc.; Flashing Flex and Flashing AT.

3. Equal.

B. Fasteners: Manufacturer approved fasteners.

C. Tape: Three inch wide seam tape. Pressure-sensitive plastic tape recommended by air barrier manufacturer for sealing joints and penetrations in air barrier.

D. Sealants and Adhesive Primers: Compatible with plastic sheet air barrier and flashings system.

1. Sealant: Dow Corning 732.

2. Spray Adhesive: Design Polymerics DP77.

3. Equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions under which plastic sheet air barrier will be installed.

B. Verify that substrate to receive air barrier has been completed and inspected before commencement of work.

C. For the installation of flashing and tape, surface shall be smooth, clean, dry and free from voids, loose substrate, protrusions, or any material that would hinder adhesion.

3.02 INSTALLATION

A. Install plastic sheet air barrier in accordance to manufacturer's installation guidelines, providing continuity throughout exterior walls. Install plastic sheet air barrier with drainage plane surface pattern in vertical position for proper drainage.

B. Install plastic sheet air barrier starting from the bottom of the building up to ensure proper overlapping of vertical and horizontal seams. Upper layer of plastic sheet air barrier shall overlap bottom layer by a minimum of six inches. Plastic sheet air barrier shall extend over the weep screed by two inches and be taped down.

C. Secure plastic sheet air barrier by fastening into studs at 12 to 18 inches on center vertically.

D. Unroll plastic sheet air barrier directly over windows and doors rough openings. Do not install fasteners within six inches of the sills and jambs of the openings and within nine inches of the header, plastic sheet air barrier shall be fastened at these locations during flashing installation.

E. Horizontal joints shall be overlapped a minimum of six inches with upper courses overlapping lower courses in water-shedding fashion. Vertical seams shall be overlapped a minimum of six inches. Overlap corners of building a minimum of 12 inches.

F. Tape vertical and horizontal seams using adhesive tape recommended by manufacturer. Seal tears and cuts with adhesive tape as recommended by manufacturer.

G. Place patch or strip of self-adhered flashing over plastic sheet air barrier where base plates, metal channels, z-girts, or other hardware will be installed.

3.03 FLASHING

A. Cut air barrier from door and window openings along jambs and sill. Cut a header flap at 45 degree angle to expose eight inches of plastic sheet air barrier to allow for head flashing

installation. Install sill flashing per manufacturer instructions, overlapping up the jambs a minimum of six inches on each side.

B. Wrap flashing around interior jamb, wall face and exterior jamb, overlapping the vertical portion of the sill flashing by at least two inches.

C. Adhere flashing to the head following manufacturer's instructions. Flashing shall wrap jamb flashings by a minimum of two inches.

D. Flash piping, conduit, duct and similar penetrations through walls, and flashing ledgers and sills as recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's technical representative shall inspect the work and submit a statement indicating that the installation has been done in conformance to manufacturer's installation instructions.

3.05 CLEANING

A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 07 5416

THERMOPLASTIC POLYOLEFIN ROOFING
(MECHANICALLY ATTACHED)

PART 1 – GENERAL

1.01 SUMMARY

A. Mechanically-attached Polyvinyl-Chloride (TPO) roofing system with flashings and other components to comprise a mechanically fastened roofing system.

B. Section Includes:

1. Mechanically fastened TPO roofing over metal decking.
2. Mechanically fastened TPO roofing over wood sheathing.

C. Related Requirements:

1. Division 01 - General Requirements.
2. Section 05 3000 - Metal Decking.
3. Section 06 1000 - Rough Carpentry.
4. Section 07 6000 - Flashing and Sheet Metal.
5. Section 07 7100 - Roof Specialties.
6. Section 07 9200 - Joint Sealants.
7. Division 22 – Plumbing.
8. Division 26 – HVAC.
9. Division 26 - Electrical.

1.02 SYSTEM DESCRIPTION

A. One layer TPO membrane, one layer barrier board over one or more layers of rigid insulation board, mechanically attached to metal decking.

1.03 SUBMITTALS

A. Shop Drawings: Submit roof plans and details. Include roof dimensions, drain and scupper locations, gutter locations, and the layout of insulation boards. Provide details indicating components, attachment, and insulation thickness; include a complete set of detail drawings from roofing manufacturer, including one set in a digital format acceptable to City. Provide calculations indicating the average R-value for the system. Indicate drainage patterns and slopes required.

B. Product Data:

1. List of each component to be used in roof system and Manufacturer’s current literature for each component, indicating physical and mechanical properties.
2. Manufacturer’s current installation literature.
3. Evidence that proposed products are compatible with TPO.
4. Material Safety Data Sheets (MSDS).

C. Evidence that proposed roof system meets requirements of local building code and has been tested and approved or listed by the following test organizations.

1. FM Global, I-90 wind uplift rating.

2. Underwriters Laboratory, Class A assembly.

D. Sample copy of Roofing Manufacturer's warranty, including no exclusion for ponding water with a no time limit for any such ponding water.

E. Sample copy of Installers' warranty.

F. Letter from Roofing Manufacturer confirming that installer is an authorized applicator of specified roof system.

G. Samples: Submit Physical samples of membrane components, with the manufactures name and product name clearly identified for each item. Samples shall be no smaller than 6 inches square. Submit samples of fasteners.

1.04 QUALITY ASSURANCE

A. Unless otherwise specified, roofing shall be installed in accordance with the National Roofing Contractors Association Manual – Latest Edition.

B. Qualifications of Manufacturer: Roofing materials shall be product of a manufacturer regularly engaged in manufacture of this product for not less than five years.

C. Qualifications of Installer: Minimum of five years experience in successfully installing the same or similar roofing materials. Work pertaining to the installation of the TPO membrane and flashings shall be completed by Contractor personnel trained and authorized by Roofing Manufacturer in those procedures.

D. Pre-Installation Conference and Inspection: After review of submittals, but prior to starting installation of the Work of this section, conduct a meeting at the Project site attended by the Architect, Project Inspector, OAR, Contractor, roofing materials installer, and a technical representative of the roofing material manufacturer. The installer and material manufacturer's technical representative shall inspect the substrates to receive the Work of this section, and report defective conditions to the Architect, Project Inspector, OAR, and Contractor.

E. Manufacturer's Representative: Provide arrangements necessary to have a trained representative of the manufacturer visit the Project site on a weekly basis during the application of roofing materials to review installation procedures.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in unopened packages bearing manufacturer's labels.

B. Store materials above grade and protected from moisture and humidity, in accordance with manufacturer's recommendations.

1.06 JOB CONDITIONS

A. TPO materials may be installed under certain adverse weather conditions but only after consultation with the Roofing Manufacturer, as installation time and system integrity may be affected.

B. Only as much new roofing as can be made weather tight each day, including flashing and detail work, shall be installed. Seams shall be cleaned and heat-welded before leaving job site that day.

C. Work shall be scheduled and executed without exposing building's interior areas to effects of inclement weather. Building and its content shall be protected.

D. Surfaces to receive insulation, barrier board, membrane or flashings shall be dry. Should surface moisture occur, provide necessary equipment to dry surface prior to installation.

E. New and temporary construction, including equipment and accessories, shall be secured to prevent damage by wind or other elements.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with finished roof as installation progresses. Contaminated membrane shall be replaced at no cost to Owner.

G. Certain TPO membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with TPO membranes. Contractor shall consult Roofing Manufacturer regarding compatibility, precautions and recommendations.

H. Do not overload roof deck or building structure.

I. Rooftop contamination that is anticipated or that is occurring shall be reported to OAR and Project Inspector to determine corrective steps to be taken.

J. Verify that roof drain lines are functioning correctly (not clogged or blocked) before starting work and after completion. Contractor shall report any such blockages in writing to OAR for corrective action prior to installation of roof system.

K. Immediately stop work if any unusual or concealed condition is discovered. Notify Owner of condition in writing, on appropriate project form, for direction.

L. Conduct fastener pullout tests in accordance with latest revision of SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values. Testing shall be performed in the presence of the Project Inspector and OAR.

1.07 WARRANTIES

A. Roofing Manufacturer's Standard 10 year No Dollar Limit (NDL) Material and Labor Warranty: Warranty shall be issued at Substantial Completion. Warranty shall be Non-Prorated, shall not exclude ponding water and no time limit shall be assigned for any ponding.

B. Contractor's five year warranty: Contractor's Performance Bond shall cover the first two years of warranty period only.

1. Supply Owner with a separate five year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within Contractor warranty's term, defective or otherwise not in accordance with Contract Documents, repair defect at no cost to Owner. Contractor's warranty obligation shall run directly to Owner. Repair shall comply with this specification.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. TPO roofing system shall be as manufactured by one of the following manufacturers:

1. Johns Manville.

2. Carlisle.

3. GAF

4. Equal.

2.02 MEMBRANE

A. Membrane, John Mansville JM TPO FB 115, thermoplastic membrane with polyester reinforcement and feltback membrane, as the basis of design.

B. Membrane shall conform to following physical properties:

1. ASTM D4434 Standard Specification for Polyvinyl Chloride (TPO) Sheet Roofing.

2. California Energy Code, Section 118 for “Cool Roof Requirements”. Reflective values shall be as follows when tested in accordance to CRRC-1:

a. Minimum initial total solar reflectance of 0.70.

b. Minimum thermal emittance of 0.75 when tested in accordance with ASTM E408 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

B. Membrane shall conform to following physical properties:

1. Color: White.

2. Thickness: Minimum of 60 mil (0.060 inch) without fleece backing.

C. Membrane shall be field fabricated. Blanket type systems will not be accepted.

2.03 FLASHING MATERIALS

A. Wall/Curb Flashing: TPO Membrane Flashing (Fiberglass): Fiberglass reinforced membrane attached to substrate using approved mechanical attachment.

B. Perimeter Edge Flashing TPO Clad Metal: TPO-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad metal shall be 25 gage, G90 galvanized metal sheet with a 20 mil unsupported TPO membrane laminated on one side.

C. Miscellaneous Flashing

1. Reglet/Termination Bar: Reglets shall be heavy-duty, extruded aluminum flashing termination reglet shall be used at walls and large curbs. Reglet shall be produced from 6063-T5, 0.10 inch to 0.12 inch thick extruded aluminum.

2. TPO Prefabricated Pipe Flashing: Prefabricated vent pipe flashing shall be made from 0.050 inch (50 mil) thick TPO membrane.

3. TPO Prefabricated Corners: Prefabricated outside and inside flashing corners shall be made of 0.060 inch (60 mil) thick membrane that is heat-welded to membrane or clad metal base flashings.

4. TPO Cover-strip: Precut flashing shall be made from TPO polyester reinforced membrane. Use to coverstrip attachment bars and attachment discs.

2.04 BARRIER BOARD

A. DensDeck, or approved equal, minimum ¼ inch thick, siliconized gypsum, fire-tested hardboard with fiberglass-mat facers.

B. DensDeck, or approved equal, minimum ½ inch thick, siliconized gypsum, fire-tested hardboard with fiberglass-mat facers.

2.05 INSULATION

A. Rigid isocyanurate foam insulation with black mat facers 4-foot by 8-foot boards, of thickness as required to achieve R-Value of **30** when combined with below roof deck batt insulation.

2.06 ATTACHMENT COMPONENTS

A. Barrier Board Attachment Plate: Provide heavy duty fasteners to attach insulation/barrier boards to roof deck. Attachment plate shall be 3-inch round, 26 gage stamping of SAE 1010 steel with an AZ 55 Galvalume coating.

B. Membrane Attachment Plate: High strength plate used with heavy duty fasteners to attach TPO roof membrane directly to roof deck. Plates shall be 20 gage, 2-inch diameter corrosion resistant steel.

C. Fasteners shall be pre-approved by roofing system manufacturer. Avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. Concrete fasteners and anchors shall have a minimum embedment of 1.25 inch and shall be approved for such use by fastener manufacturer. Miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by fastener manufacturer.

D. Solvent-based reactivating-type adhesive used to attach membrane to flashing substrate.

E. FM Global approved, heavy-duty, 14 gage, galvanized or stainless, roll-formed steel bar used to attach membrane to roof decks. The formed steel is pre-punched with holes every 1 inch on center to allow various Fastener spacing options.

2.07 WALKWAY PROTECTION

A. TPO Walk Tread: Polyester reinforced, 0.096 inch, weldable membrane with surface embossment.

2.08 MISCELLANEOUS ACCESSORIES

A. Aluminum Tape: 2-inch wide pressure-sensitive aluminum tape shall be used as a separation layer between small areas of asphalt contamination and membrane and as a bond-breaker under cover-strip at clad metal joints.

B. Sealing Tape Strip: Compressible foam with pressure-sensitive adhesive on one side. Use with metal flashings as a preventive measure against air and wind blown moisture entry.

C. Membrane Cleaner: High quality solvent cleaner shall be used for general cleaning of residual asphalt, scuff marks, etcetera, from membrane surface. Membrane cleaner shall be used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if membrane is not welded same day it is unrolled.

2.09 SEALANTS

A. Multi-Purpose Sealant (for termination details): Manufacturer’s recommendation as approved.

B. Depending on substrates, for temporary overnight tie-ins provide one of the following:

1. Multiple layers of roofing cement and felt conforming to ASTM D4586.

2. Mechanical attachment with rigid bars and compressed sealant.

PART 3 – EXECUTION

3.01 SUBSTRATE CONDITION

A. Contractor shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

1. Roof curbs, nailers, equipment supports, vents and other roof penetrations shall be properly secured and prepared to receive new roofing materials.

2. Surfaces shall be smooth and free of dirt, debris and incompatible materials.

3. Roof surfaces shall be free of water.

3.02 SUBSTRATE PREPARATION

A. Dry, clean and smooth substrate shall be prepared to receive TPO mechanically-attached roof system. Contractor shall inspect substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect quality of work. Substrate shall be free of flaws, sharp edges, loose granules and foreign material, oil and grease. Roofing shall not start until defects have been corrected. TPO membrane shall be applied over compatible and accepted substrates only.

B. Prior to and during application, dirt, debris and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.

3.03 INSULATION AND BARRIER BOARD INSTALLATION

A. Insulation and barrier board shall be installed according to manufacturer's instructions.

B. Insulation and barrier board shall be neatly cut to fit around penetrations and projections.

C. Do not install more insulation and barrier board than can be covered with TPO membrane by end of day or onset of inclement weather.

D. When the total insulation thickness exceeds 2 1/2 inches, use at least two layers of insulation. Stagger joints at least 12 inches between layers.

E. Mechanical Attachment:

1. Barrier board shall be mechanically fastened to deck with approved fasteners and plates at a rate of six per four-foot by eight-foot board. The location of the fasteners and plates shall cause the barrier board to rest evenly on roof deck or substrate so there is no significant and avoidable air spaces between boards and substrate. Each board shall be installed tightly against adjacent boards on all sides.

2. Fasteners shall be installed in accordance with manufacturer's instructions. Fasteners shall have a minimum penetration into structural deck as recommended by manufacturer.

3.04 INSTALLATION OF THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE

A. The surface of substrate shall be inspected prior to installation of TPO roof membrane. The substrate shall be clean, dry, and free from debris and smooth, with no surface roughness or contamination. Broken, delaminated, wet or damaged barrier boards shall be removed and replaced.

B. General

1. TPO membrane shall be attached with fasteners and discs according to Roofing Manufacturer and FM Global's requirements.

2. Membrane overlaps shall be shingled with flow of water where possible.

3. Tack welding of TPO membrane for purposes of temporary restraint during installation on windy days is not permitted.

4. TPO membrane shall extend over edge of roof and be turned down face a minimum of two inches wherever clad metal edging is to be installed.

C. Perimeter and Corner Areas

1. Over properly installed and prepared substrate surface, install TPO half-width rolls parallel to perimeter. Number of adjacent half-rolls shall be determined according to FM Global guidelines and Roofing Manufacturer's Technical Specifications. Fasteners and discs shall be installed along edge of membrane on fastening line at a spacing of nine inches on center.

2. Perimeter area is defined as outer boundary of roof. If roof is composed of different levels, each area shall be treated as an individual roof. Internal expansion joints and firewalls are not full perimeters. Refer to FM Global Data Sheet 1-28 for more information.

3. The ridge area is defined as high point in roof area formed by two intersecting planes. When sum of slopes is a minimum of 4 inches in 12 inches (30 degrees), each side of ridge shall be treated as a perimeter area.

4. Hot-air weld overlaps according to Roofing Manufacturer's requirements. Take test cuts at least 3 times per day.

D. Interior Area

1. Install full-width rolls over properly installed and prepared substrate. Fasteners and discs shall be installed at perimeter at NINE (9) inches on center. Fasteners shall clamp TPO membrane tightly to substrate.

2. Hot-air weld overlaps according to Roofing Manufacturer's recommendations. Take test cuts at least 3 times per day.

E. Secure Perimeter and Rooftop Penetrations

1. Install fasteners and discs around perimeters, at base of walls, drains, curbs, vent pipes, or any other roof penetrations. Fasteners shall be installed at a spacing equal to perimeter, and according to manufacturer's instructions. Fasteners shall be installed using fastener manufacturer's recommended torque-sensitive fastening tools with depth locators. Fasteners shall clamp TPO membrane tightly to substrate.

2. TPO membrane flashings shall extend 2 ½ inches past discs and be hot-air welded to TPO deck membrane.

3.05 WELDING OF SEAMS

A. General

1. Seams shall be hot-air welded. Seam overlaps shall be 3 inches (75 mm) wide when automatic machine welding and 4 inches wide when hand-welding.

2. Welding equipment shall be approved by Roofing Manufacturer. Mechanics intending to use the equipment shall have successfully completed a training course provided by the Roofing Manufacturer's Technical Representative prior to welding.

3. Membrane to be welded shall be clean and dry.

B. Quality Control of Welded Seams: Contractor shall check welded seams for continuity. On-site evaluation of welded seams shall be made daily by Contractor at locations directed by OAR. One inch wide cross-section samples of welded seams shall be taken three times a day, minimum. Correct welds displaying failure, from shearing of membrane, prior to separation of weld. Each test cut shall be patched by Contractor at no extra cost to Owner.

3.06 MEMBRANE FLASHINGS

A. Flashings shall be installed concurrently with roof membrane as job progresses. No temporary flashings shall be allowed without prior written approval of City. Approval shall only be for specific locations on specific dates. If water enters under newly completed roofing, affected area shall be removed and replaced at Contractor's expense. Flashing shall be attached to compatible, dry, smooth, and solvent-resistant surfaces.

B. Install discs according to Drawings submitted by Contractor and approved by Owner with approved fasteners into structural deck at base of parapets, walls and curbs. Discs may be

required by roofing material manufacturer at base of transitions, peaks, and valleys according to roofing manufacturer's details.

C. Flashings shall extend a minimum of 8 inches above roofing level unless otherwise indicated.

D. Flashing membranes shall be attached consistently to substrates. Interior and exterior corners and miters shall be cut and hot-air welded into place.

E. Flashing membranes shall be mechanically fastened along counter-flashed top edge with batten bar at 6 to 8 inches on center.

F. TPO flashings shall be terminated according to Roofing Manufacturer's recommended details.

3.07 TPO CLAD METAL BASE FLASHINGS/EDGE METAL

A. Flashings shall be installed concurrently with roof membrane as job progresses. No temporary flashings shall be allowed without prior written approval of City and Roofing Manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under newly completed roofing due to incomplete flashings, affected area shall be removed and replaced at Contractor's expense.

B. TPO clad metal flashings shall be formed and installed according to detail drawings submitted by Contractor and approved by Owner.

1. Metal flashings shall be fastened with two rows of post galvanized flat head annular ring nails, 4 inches on center staggered. Fasteners shall penetrate wood nailers a minimum of 1 inch.

2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

C. Clad metal shall be installed over field membrane and stripped in with a 6-inch minimum TPO cover strip, prior to installation of the cover.

D. Adjacent sheets of TPO clad shall be spaced ¼ inch apart. The joint shall be covered with 2 inch wide aluminum tape. A 4-inch minimum wide strip of TPO flashing membrane shall be hot-air welded over joint.

E. Clad metal shall be installed over field membrane and stripped in with a 6-inch minimum TPO cover strip, prior to installation of the 8-inch cover plate target.

3.08 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to applicable requirements of following:

1. Specification Section 07 6000, Flashing and Sheet Metal.

2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) – Latest Edition.

3. National Roofing Contractor's Association (NRCA) Manual – Latest Edition.

B. Metal, other than that provided by Roofing Manufacturer, is not covered under Roofing Manufacturer's warranty, but will be included in Contractor's warranty.

C. Complete metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

D. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

E. Metal joints shall be watertight.

F. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate wood nailers a minimum of 1 inch.

G. Airtight and continuous metal cleats are required behind metal fascias. Cleats shall be fastened 12 inches on center into wood nailers or masonry wall.

H. Counter flashings shall overlap base flashings at least 4 inches.

3.09 COMPLETION

A. Single ply roofing shall be washed with running water, mild (environmentally safe) detergent, and clean brooms after completion of minor punch list items, with cleaning being the final item.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials on a daily basis and legally dispose of off Project site.

3.11 PROTECTION

A. Protect new roofing from damage by walking or for equipment movement and storage

B. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 07 6000

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sheet metal flashings in connection with roofing.
2. Reglet and counter flashing assemblies.
3. Miscellaneous metal flashing and counter flashing as required, except where provided under Divisions 22, Plumbing, 23, HVAC, or 26, Electrical.
4. Coping caps.
5. Gravel stops and metal edging.
6. Gutters and downspouts.
8. Splash pans where downspouts empty onto roofing.
7. Conductor heads.
8. Drip flashings.
9. Sheet metal covering at outside storage units.
10. Sheet metal wall coverings.
11. Roof pipe flashings.
12. Roof expansion joint covers.
13. Other sheet metal items, not necessarily specified herein or in other sections, but required to prevent penetration of water into building.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 05 3000 – Metal Decking.
3. Section 07 2200 - Roof and Deck Insulation.
4. Section 07 9200 - Joint Sealants.
5. Section 08 6323 - Metal-Framed Skylights.
6. Section 09 2423 - Cement Plaster and Metal Lath
7. Division 22 –- Plumbing.

8. Division 23 - HVAC.

9. Division 26 - Electrical.

1.02 SUBMITTALS

A. Shop Drawings: Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

B. Samples: Submit Samples for materials or assemblies as requested.

C. Product Data: Submit brochures of manufactured items.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Materials shall conform to following standards:

1. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

2. ASTM A653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM B370 - Copper Sheet and Strip for Building Construction.

C. Pre-installation Meetings: Refer to Division 07 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install bent or otherwise damaged materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Sheet Steel: ASTM A653, coating designation G90, hot-dip galvanized.

B. Copper Plate, Sheet and Strip: ASTM B370, cold-rolled, tempered. Copper sheet and strip shall be cold-rolled-temper.

C. Stainless Steel: Plate, sheet and strip shall conform to ASTM A167, Type 304 or Type 316, No. 4 finish on exposed surfaces and No. 2 finish on concealed surfaces unless otherwise specified or indicated. Furnish Type 304 for general applications and Type 316 where exposed to acidic or alkaline conditions.

D. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. As-Milled Finish: **One-side bright mill**

E. Fastenings:

1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.

2. Copper: Nails, rivets, and other fastenings furnished in connection with copper sheet metal Work, shall be manufactured from hard-temper copper or hard brass.

3. Stainless Steel: Nails, rivets and other fastenings furnished in connection with stainless steel Work, shall be 300 series alloy to match alloy of stainless steel being fastened.

F. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, lead and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

G. Solder: ASTM B32, Grade 5A, composed of 95-5 tin-antimony. Name of product manufacturer and grade designation shall be labeled, stamped or cast onto each coil or bar.

2.02 FABRICATION

A. General:

1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a ½ inch minimum hemmed edge.

2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Fill joint completely with solder. Clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.

3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.

B. Gutters and Downspouts:

1. Gutters: Fabricate from 22 gage galvanized steel to match existing size and design unless otherwise indicated. Maximum length of gutter shall be 40 feet between end or expansion joints unless the system is specially designed to accommodate the greater expansion, the larger flow and the need for special supports. Drain gutter towards nearest downspout and provide an expansion joint at mid-point between downspout outlets, but not to exceed 40 feet on center. Gutters shall not pond water. Rivet joints and ends with a minimum of 6 rivets per joint or maximum rivet spacing not to exceed 1 ½-inch on center and ½ inch from the edge of the metal, consisting of 3-inch overlap. Sweat solder from inside of gutter and in horizontal position where possible. Neatly fit downspouts to gutter using a slip joint. Provide expansion joints, consisting of 3-inch lap joints at not over feet.

2. Form and install sheet metal Work to provide allowance for expansion and contraction without causing undue stresses in the completed Work.

3. Downspouts: Fabricate downspouts from 3-inch round, or 3-inch by 4-inch rectangular shapes, 16 gage steel tubing with butt joints and mitered elbows, sized as indicated. Downspouts shall be constructed with conductor heads every 40 feet to admit air and prevent vacuum. Keep downspouts offsets to a maximum of 10 feet. Downspout shall be fabricated with elbows at bottom discharge or connected to drains as indicated. Joints, except expansion joints shall be sealed with a continuous weld. Galvanize downspouts after fabrication.

4. Outlets: Fabricate outlets of 22 gage galvanized sheet steel with a 1/4 inch rolled flanged soldered continuously to gutter. Outside diameter shall be 1/8 inch less than the inside diameter of the downspout and extend into downspout 4 inches. Install a removable wire “bulb type” strainer to outlet opening. Strainer shall be fabricated of 22 gage galvanized steel and ½ inch hardware cloth.

C. Conductor Heads:

1. Fabricate conductor heads and outlets from 22 gage galvanized sheet steel. Cover tops of the conductor heads with 22 gage galvanized ¼ inch wire mesh soldered securely to separately fabricated frame and mechanically fastened to top conductor head with a minimum of two fasteners.

D. Gravel Stops: Provide 24 gage galvanized sheet steel gravel stops wherever roof area drops to a lower level; at the eaves and rake of roof, where roof comes to an abrupt edge, and where indicated. Stops shall be of height indicated and shall be fabricated with two flanges. Horizontal flange shall be not less than 4 inches wide, and vertical flange shall extend down over vertical surfaces of trim or gutter. Gravel stops shall lap 4 inches at ends and corners, and shall be fabricated by notching and interlocking vertical face flanges. Contact surfaces of lapped flanges, including raised areas, vertical face and corners, shall be completely covered with flashing compound. Fabricate lap joints so that they will be in the direction of water flow. Where flanges are over five inches wide, provide 20 gage continuous cleats fastened at 24 inches on center.

E. Overflow Outlets: Provide galvanized sheet steel overflow outlets at locations and of sizes indicated. Outlets shall extend through full thickness of wall in one continuous piece and completely line the opening. On outside face of wall, top and sides of outlet shall finish 1/2 inch on surface of wall. Bottom of outlet shall project 1 ½ inches beyond face of wall, and shall be bent down slightly. Outlets shall be sealed on the surface of the building. On inside face, side and bottom flanges shall extend not less than 8 inches beyond edge of opening, and not less than 6 inches at top. Outlets shall be installed at time roof is being installed.

F. Reglet Type Counterflashing: Where roof comes in contact with vertical surfaces, provide counterflashing. Set top of counter flashing 8 inches above roof deck unless otherwise indicated, and extend down at least 5 inches or to top of cant strip. Counterflashing and reglet shall be 22 gage galvanized sheet steel. Lap counter flashing and reglet 3 inches minimum at splices and miter at angles, or supply special metal corner fittings. Reglet and method of securing flashing shall be so constructed that flashing is firmly locked in place, but may be readily removed for replacement.

G. Splash Pans: Provide splash pans for all downspouts, which empty onto lower roofs. Pans shall be galvanized sheet steel 12-inch by 18-inch, unless otherwise indicated, and turned up 2 inches on at least three sides.

H. Roof Expansion Joint Covers: Fabricate of 22 gage galvanized sheet steel, as detailed. One side of joint shall be zee shaped, with 3-inch standing leg extended over the joint and turned down. The other side shall be box shaped, fabricated to extend over the joint, over the standing leg, and turn down to form a water barrier. Prefabricated bellows type joint covers are not permitted.

I. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed. At wood construction, nail flashing to framing before paper backed lath is installed.

J. Roof Pipe Flashings: Provide PVC flashings or prefabricated welded or seamless flashings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

A. General: Coordinate with installation of underlayment indicated in the Drawings and specified in Section 09 2423.

B. Gutters and Downspouts:

1. Anchor gutters to structure with 10 gage steel straps, galvanized after fabricating. Secure straps with galvanized fasteners at 3 feet on center. Drill pilot holes and use 12 by 2-inch pan head screws.

2. Install 1/4 inch galvanized wire mesh continuous cover on gutter.

3. Secure downspouts to walls with 1/8 inch by 2-inch galvanized steel straps. Straps shall be located at top, bottom, and at not over 10 feet on center. Block downspouts out ½ inch from the finish wall surfaces and 1 inch from the bottom of downspout grade. Secure straps to wall framing with 1/4 inch by 2-inch long galvanized anchors. Expansion type anchors shall be provided when anchoring to concrete and masonry. Provide toggle bolts for attachment to masonry or plaster. At steel columns, provide fasteners as indicated. Plastic anchors are not permitted.

4. Anchor conductor heads to walls with 1/4 inch diameter by 2 ½-inch long galvanized lag screws or 1/4 inch expansion type anchors.

C. Reglets: Install reglets at constant height above cant or as indicated. Provide minimum 3-inch lap at end splices of reglets. Seal laps watertight.

D. Counterflashing:

1. Install at constant horizontal elevation across roof slope and slope at constant height above cant or as indicated.

2. Provide minimum 3-inch lap at all end splices of counterflashing.

E. Galvanized sheet steel parapet coping and flashing shall be continuous over top of parapet to form a watertight cap, with waterproof seams at approximately 10 feet on center, or as indicated. Anchor coping to outside of wall with a continuous cleat face nailed at 24 inch centers. Coping shall be fastened on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Corners and angles shall be lapped and soldered; do not install joint sealant.

3.03 TESTING

A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Sealing of interior partition joints.

B. Sealing of ceramic tile joints.

1.2 SUBMITTALS

A. Product Data: Required

B. Samples: Required

1.3 QUALITY ASSURANCE

A. Quality Standards:
1. SWRI (Sealant, Waterproofing and Restoration Institute) requirements for materials and installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Interior partition joints: Silicone Sealant - single component, 50 percent elongation capability, manufactured by GE or Dow.

B. Ceramic tile joints: Silicone Sealant - single component, solvent curing, fungus resistant, 25 percent elongation capability, manufactured by GE or Dow.

2.2 ACCESSORIES/MIXES

A. Joint Backing: Round open cell polyethylene urethane foam or butyl rod.

PART 3 – EXECUTION

3.1 Install all products in accordance with manufacturer’s guidelines and printed instructions.

END OF SECTION

SECTION 08 1100

METAL DOOR FRAMES

PART 1 – GENERAL

1.1 SUMMARY

A. Metal door frames.

1.2 SUBMITTALS

A. Product Data: Required

B. Shop Drawings: Required

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. UL 10B, NFPA 80 and ASTM E-152: Fire rated door and frame construction:
   2. Standards for Facility Accessibility by the Physically Handicapped.

B. Quality Standards:
   1. Hollow metal work: ANSI/SDI-100 Grade II Model 3 Standard Steel Doors and Frames.

PART 2 -PRODUCTS

2.1 Frames: 1 ¾" inch thick full flush design, seamless construction.

A. Frames: 16 gauge thick material, core thickness

2.2 FABRICATION

A. Steel Doors Frames
   1. Shop Assembly:
      a. Fabricate frames as welded unit.
   2. Shop/Factory Finishing:
      a. Steel sheet: Baked primer at interior doors.

PART 3 – EXECUTION

3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

END OF SECTION

SECTION 08 1400

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flush wood doors.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 081100 - Metal Doors and Frames: Metal frames for wood doors.
   2. Section 087100 - Door Hardware: Hardware coordination.
   3. Section 099100 - Painting: Field painting of doors and frames.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM);
   1. ASTM E 152 - Methods of Fire Tests of Door Assemblies.

B. Architectural Woodwork Institute (AWI):
   1. AWI 1300 - Flush Hollow and Solid Core Doors.

C. National Electrical Manufacturers Association (NEMA):
   1. NEMA LD-3 - High Pressure Decorative Laminates.

D. National Fire Protection Association (NFPA):
   1. NFPA 80 - Specification for Fire Doors and Windows.

E. Window and Door Manufactures Association (WDMA):
   1. WDMA I.S. 1A-97 - Architectural Wood Flush Doors.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, special blocking for hardware, and factory machining criteria. Indicate cutouts for door louvers.
   2. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
      b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Special Warranty: Submit written special warranty forms completed in City of Torrance name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWI 1300 for Custom Grade.

B. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

C. Regulatory Requirements:
   1. Fire Door Construction: Conform to ASTM E 152.
   2. Installed Fire Rated Door Assembly: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Package, deliver, and store doors in accordance with AWI Section 013300.

1.6 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:
   1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
   2. Warranty Period: Full life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Algoma Hardwoods, Inc., Algoma, WI, (800) 678-8910.
   2. Eggers Industries, Neena, WI, (920) 722-6444.
   3. Mohawk Flush Doors, Inc., Northumberland, PA (717) 473-3557.
   4. Marshfield DoorSystems, Incorporated, Marshfield, WI (800) 869-3667.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Solid Core Wood Doors (Interior Use): AWI 1300.
   1. Thickness: Indicated on Drawings.
   2. Veneer: AWI 1300-S-9 SLC-5 ME.
   3. Face Veneer: AWI Custom quality rotary cut birch for paint finish.
   4. Core Construction:
      a. Non Fire-Rated: SLC solid stave lumber.
      b. Fire-Rated: Type FD 1-1/2 solid stave lumber.

5. Grade: AWI Custom.

B. Provide fire-rated labeled doors where indicated on Drawings.

2.3 FABRICATION

A. Fabricate non fire-rated doors in accordance with AWI 1300.

B. Fabricate fire-rated doors to AWI 1300 and to Underwriters Laboratories Incorporated requirements. Attach fire rating label to doors.

C. Furnish and install lock blocks at lock edge, and top of door closer for hardware reinforcement.

D. Vertical Exposed Edge of Stiles:
1. Wood Doors: Of same species as veneer facing.

E. Bond edge banding to cores.

F. Factory machine door for door hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

G. Factory fit doors for frame opening dimensions identified on approved shop drawings.

H. Doors may be provided pre-hung set in frames and ready for installation in rough openings. Metal door frames specified in Section 081100.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 INSTALLATION

A. Install non fire-rated doors in accordance with AWI Quality Standards requirements.

B. Install fire-rated doors in accordance with AWI Quality Standard and NFPA 80 requirements.

C. Machine cut for hardware. Install door hardware specified in Section 087100.

D. Install door louvers plumb and level.

E. Field paint doors and door louvers as specified in Section 099100, color as indicated on Drawings.

3.3 CONSTRUCTION

A. Interface with Other Work:
   1. Coordinate frame installation with size, location, and installation.
   2. Coordinate with door opening construction, door frame, and door hardware installation.

B. Site Tolerances:
   1. Conform to AWI requirements for fit and clearance tolerances.
   2. Conform to AWI 1300 requirements for maximum diagonal warp.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

B. Inspect door and frame installation, alignment, attachment to structure, hardware installation, and operation.

3.5 ADJUSTING AND CLEANING

A. Adjust hardware for smooth and balanced door movement.

3.6 PROTECTION

A. Section 017300 - Execution: Protecting installed work.

B. Protect finished Work from damage.

END OF SECTION

SECTION 085113

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single hung aluminum windows.

2. Fixed aluminum windows.

B. Related Documents: The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 084113 – Aluminum-Framed Entrances and Storefronts.

1.2 REFERENCES

A. Aluminum Association (AA):

1. AA-M12 C22 A41.
2. AA-M12 C22 A44.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA 611.
2. AAMA 2605.
3. AAMA 2604.
4. AAMA 910.
5. AAMA 503.1.
6. AAMA1503.
7. AAMA1302.5.
8. AAMA 502.

C. American Society for Testing and Materials (ASTM):

1. ASTM E283.
2. ASTM E547.
3. ASTM E331.
4. ASTM E330.
5. ASTM F588.
6. ASTM B221.
7. ASTM C864.
8. ASTM C1036.
9. ASTM E774.
10. ASTM C1043.
11. ASTM E783.
12. ASTM E1105.

D. American National Standards Institute (ANSI):

1. ANSI/AAMA 101.
2. ANSI H35.2.
3. ANSI Z97.1.

1.3 SYSTEM DESCRIPTION

A. Commercial Grade Aluminum windows including glass and factory glazing, trims, sills, stools, perimeter seals, accessories and anchors required for a complete installation.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:
   a. Product Data: Indicate construction details, material descriptions, glazing, fabrication methods, dimensions of components, profiles, hardware and finishes.
2. Shop Drawings:
   a. Shop Drawings: Include plans, elevations and sections of aluminum windows and trim, head, sill and jamb details, hardware, accessories, required clearances, installation details including anchors, flashing and sealants.
3. Samples:
   a. Aluminum Extrusions: Submit samples 12 inches (300 mm) long in size for each color of finished aluminum surface specified.
   b. Hardware: Submit full size sample for each type of hardware and finish specified.
   c. Glazing: Submit 12 x 12 inches (300 x 300 mm) in size samples illustrating finished glass units, and glazing materials.
4. Window Schedule:
   a. Use same window designations indicated on drawings.
5. Assurance/Control Submittals:
   a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
   b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Special Warranty: Submit written special warranty with forms completed in City of Torrance name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 PROJECT CONDITIONS

A. Field measurements:

1. Verify dimensions of openings to receive aluminum windows prior to window fabrication.

1.7 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:

1. The manufacturer/installer shall warrant the product and installation to be free from defective material and workmanship and shall replace or repair any defective component or system, in whole or part, as necessary to restore the product to its original intended state and integrity. Failures include the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection, water leakage, condensation and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Failure of insulating glass.
   e. Deterioration of materials and finishes beyond normal weathering.
2. Warranty Period:
   a. Window: 5 years from date of Substantial Completion.
   b. Glazing Units: 5 years from date of Substantial Completion.
   c. Aluminum Finish: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. EFCO Corporation; Monett, MO. (800) 221-4169.
2. Graham Architectural Products Corp.; York, PA. (800) 755-6274.
3. Kawneer North America.; Norcross, GA. (770) 449-5555.
4. Peerless Products Inc.; Fort Scott, KS. (866) 420-4000.
5. TRACO.; Cranberry Township, PA. (800) 837-7002.
6. YKK AP America Inc.; Austell, GA. (678) 838-6000.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Definitions and minimum standards of performance, materials, components, accessories and fabrication to comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent requirements are indicated.

1. Attach label indicating AMMA Certification to each window.

B. Performance Class and Grade:

1. Minimum Performance Class: C.
2. Minimum Performance Grade: 30.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.60 Btu/sq. ft. x h x deg F (3.43 W/sq.m x K).

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, indicating a CRF of 45.

F. Thermal Movements: Provide aluminum windows and anchorages that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, overstressing of components, joint and connection failures.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

G. Sound Transmission Class (STC): Rated for not less than [__] STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

2.3 ALUMINUM WINDOWS

A. Provide single hung aluminum windows as indicated.

B. Provide fixed aluminum windows as indicated.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440. Fabricate frames and sashes with integral, concealed, thermal barriers between exterior and interior materials that eliminates metal-to-metal contact.

D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3. Provide fully tempered where indicated on drawings or where required by applicable building code.

E. Provide Energy Star Label on glazing indicating compliance with DOE Energy Star requirements.

F. Insulating Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, q3.
2. Tint: Gray.
3. Provide fully tempered units where indicated on drawings or where required by applicable building code.
4. Filling: Fill space between glass lites with air.
5. Low-E Coating: Sputtered on second or third surface.

G. Glazing System: Manufacturer's standard factory-glazing system.

H. Hardware: Provide manufacturer's standard hardware designed to accommodate sash weight and dimensions, and fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material.

1. Hardware Finish: As indicated or if not indicated, as selected by Architect from manufacturer's full range.
2. Provide custodial locks.

G. Provide full perimeter weather stripping for operable sash.

H. Provide non-corrosive fasteners compatible with hardware, window framing members, anchors and other window components. Do not use exposed fasteners to the greatest extent possible.

2.4 WINDOW SCREENS

A. Provide outside window screen for each operable sash. Window screens to be integrated with window frame.

B. Provide manufacturers standard aluminum frame with aluminum wire fabric.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Fabricate with integral weep holes to conduct water to exterior.

B. Factory glaze windows.

C. Weather strip each operable sash.

D. Complete fabrication assembly, finishing, hardware installation, glazing and other work to greatest extent possible in factory.

2.6 FINISHES

A. Comply with NAAMM"s "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage with temporary, strippable protective covering.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA611.

D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA611.

1. Color: Clear anodized aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION

A. Install aluminum windows, hardware, accessories and other components in accordance with aluminum window manufacturer's written instructions and approved shop drawings.

B. Install windows plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

C. Provide thermal isolation where aluminum windows penetrate or disrupt building insulation.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to drain to exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

F. Coordinate attachment and seal of perimeter air and vapor barrier materials.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

3.3 ADJUSTING

A. Section 017300 - Execution: Adjusting installed work.

B. Adjust operating hardware and sash for smooth operation.

3.4 CLEANING

A. Section 017704 - Closeout Procedures and Training: Cleaning installed work.

B. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Protective films and coverings to remain in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, scratched or otherwise damaged during construction period.

D. Protect window surfaces from contact with contaminating substances from construction operations. If contact occurs, remove contaminants immediately in accordance with window manufacturer's written instructions.

END OF SECTION

SECTION 086200

UNIT SKYLIGHTS

1.1 SUMMARY

A. Section Includes:
   1. Preformed plastic skylights with integral metal frame.
   2. Integral insulated curb.
   3. Security grille/glazing.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 627 - Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications.
   2. ASTM B 209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. Federal Specifications (FS):
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Comply with OSHA Fall Protection Regulation 29 CFR 1910.23
   2. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 F degrees without causing detrimental effects to system or components.
   3. Provide glazing system with minimum visible light transmittance of 49 percent, maximum ultraviolet transmission of 10 percent and shading coefficient of 0.63.
   4. Provide minimum U-value 0.56.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Structural, thermal, and daylighting performance values.
   2. Shop Drawings:
      a. Indicate skylight configurations, dimensions, locations, fastening methods, and installation details.
      b. Indicate construction and installation of security grille or security glazing assembly. Detail attachment to building structure. Specify fastening devices and spacing.
   3. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
      b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

c. Manufacturer's Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
d. Manufacturers Structural Data indicating Impact Resistance or capacity.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.7 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:
1. Correct defective work, including leakage due to defective skylight materials or workmanship,
2. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Wasco Skylights, Wells, ME (800) 388-0293, Product: Sentinel Curb Mount (SS2)
2. Kingspan Light & Air, Santa Ana, CA (714) 540-8950, Product: Tufflite Polycarbonate F5
3. American Skylites, Inc., Arlington, TX (800) 772-7401, Product: Fall Protection Skylight

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COMPONENTS

A. Plastic Unit Skylight: Factory-assembled glazing in aluminum frame; double dome.
1. Rectangular domed shape. Manual openable with insect screen.
2. Nominal Size: Indicated on Drawings.

B. Double Glazing: Polycarbonate plastic; factory sealed, conforming to Occupational Health and Safely Administration (OSHA) requirements for skylight glazing and construction.
1. Outer Glazing: White or Frosted.
2. Inner Glazing: Clear transparent.

C. Frames: ASTM B 221 Extruded aluminum, thermally broken, reinforced and welded corner joints, concealed fasteners, integral curb frame mounting flange to receive roofing flashing system, with integral condensation collection drainage gutter, glazing retainer; clear anodized finish.

D. Support Curbs: ASTM B 209 Sheet aluminum, sandwich construction; 1 inch thick, height as indicated on Drawings; rigid plastic insulation; with integral flange for anchorage to roof deck.

2.3 SECURITY GRILLE/GLAZING

A. Furnish and install a security grille or security glazing. Contractor option.
   1. Grille: Factory fabricated 1/2-inch diameter, ASTM A 627, tool-resistant, round steel bars spaced 4 inches on center, interlocked with 3/8-inch x 2-inch horizontal flats at 18 inches on center.
   2. Glazing: 5/16-inch-thick safety tempered laminated sheets of glass with an interlayer of 0.075-inch vinyl or 1/4-inch polycarbonate in steel "U" shape glazing frame with mitered corners.

2.4 ACCESSORIES

A. Anchorage Devices: Type recommended by manufacturer, concealed.

B. Protective Back Coating: Bituminous, FS TT-C-494.

C. Sealant: Specified in Section 079200 - Joint Sealants.

2.5 FABRICATION

A. Fabricate free of visual distortion and defects.

B. Fabricate to achieve leakproof, weathertight assembly.

C. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.

D. Furnish and install decals on skylight glazing, clearly visible at exterior, warning persons not to sit or step on skylight unit, in conformance with OSHA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify that opening sizes and locations are as indicated on Drawings.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

A. Install aluminum curb assembly, fastening securely to roof decking.

B. Place skylight units and secure to curb assembly. Install counterflashing as required.

C. Apply sealant to achieve watertight assembly.

D. Install security grille or security glazing assembly, within skylight roof deck opening, to steel roof structure. Rigidly attach using methods.

3.4 CONSTRUCTION

A. Interface with Other Work: Coordinate skylight installation with roofing insulation and roofing membrane installation.

3.5 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces; wipe surfaces clean.

C. Remove excess sealant.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Finish Hardware items which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
2. Hinges.
3. Locks and latches.
4. Operating trim.
5. Accessories for pairs of doors and exit devices.
6. Closing devices.
7. Door controls.
8. Stops and holders.
9. Miscellaneous hardware.

B. Related Sections:
1. Section 016000, Product Requirements.

1.2 REFERENCES

A. American National Standards Institute (ANSI);
1. ANSI A156.3 - National Standard for Exit devices.
2. ANSI A156.4 - National Standard for Door Controls - Closers.
3. ANSI A156.6 - National Standard for Architectural Door Trim.
4. ANSI A156.13 - National Standard for Mortise Locks & Latches.

B. National Fire Protection Association (NFPA):
1. NFPA 80 - Fire Doors and Windows.
2. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
3. NFPA 252 - Fire Tests of Door Assemblies.

C. Underwriters Laboratories (UL):
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 305 - Panic Hardware.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

B. Product Data: Submit manufacturers' technical product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and finishes.

C. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.

1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
    a. Type, style, function, size and finish of each hardware item.
    b. Name and manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
    e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
    f. Mounting locations for hardware.
    g. Door and frame sizes and materials.
    h. Keying information.
2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

D. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, as selected by the General Services Director or Designee, finished as required, and tagged with full description for coordination with schedule.
1. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

E. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

F. Written Report: Before final inspection, a detailed written report shall be made to the General Services Director or Designee covering application and condition of the Finish Hardware.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:
1. ANSI A117.1
2. NFPA 101.
3. NFPA 80.
4. NFPA 252.
5. UL 10B.
6. UL 305.

B. Regulatory Requirements:
1. Conform to applicable code for requirements applicable to fire rated doors and frames.
2. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., and acceptable to the public authority as suitable for the purpose specified and indicated.

C. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware to similar projects for a period of not less than 2 years, and who employs an experienced architectural hardware consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements.

E. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Within each Article in Part 2 hardware products from a few manufacturers are specified to establish a standard of quality and minimum functional requirements.

B. All items of a particular hardware category i.e. locksets, closers, hinges shall be of the same manufacturer.

C. Hardware Manufacturers:

1.	Adams Rite / ASSA ABLOY, Phoenix, AZ	(800) 872-3267
2.	Alarm Lock Systems, Amityville, NY	(800) 252-5625
3.	Baldwin Hardware Corp., Reading, PA	(888) 592-2216
4.	Bommer, Landrum, SC	(800) 334-1654
5.	Best Access Systems, Indianapolis, IN	(800) 311-1705
6.	Corbin Russwin, Berlin, CT	(800) 543-3658
7.	Detex Corporation, New Brannfels, TX	(800) 729-3839
8.	Falcon/Dor-O-Matic, Harwood Heights, IL	(800) 815-1517
9.	Door Controls International, Dexter, MI	(800) 742-3634
10.	Folger Adam Company, Lemont, IL	(800) 260-9001
11.	Glynn-Johnson, Indianapolis, IN	(877) 613-8766
12.	Hager Companies, St. Louis, MO	(800) 255-3590
13.	Hiawatha, Inc., Bloomington, MN	(800) 777-1686
14.	H. B. Ives, Wallingford, CT	(888) 371-7331
15.	Knape & Vogt Manufacturing Co., Grand Rapids, MI	(800) 253-1561
16.	LCN Closers, Princeton, IL	(800) 526-2400
17.	McKinney Hinge, Scranton, PA	(800) 346-7707
18.	National Guard Products, Incorporated, Memphis, TN	(800) 647-7874
19.	Norton, Charlotte, NC	(800) 393-1097
20.	NT Falcon, Brea, CA	(914) 632-9774
21.	NT Monarch, Shepherdsville, KY	(800) 826-5792
22.	PDQ Manufacturing, Leola, PA	(800) 441-9692
23.	Pemko, Ventura, CA	(800) 824-3018
24.	Precision Hardware, Romulus, MI	(317) 849-2250
25.	Reese Enterprises, Incorporated, Rosemount, MN	(800) 328-0953
26.	Rixson-Firemark, Franklin Park, IL	(866) 474-9766
27.	Rockwood Manufacturing, Rockwood, PA	(800) 458-2424
28.	Sargent, New Haven, CT	(800) 727-5477
29.	Sargent & Greenleaf, Nicholasville, KY	(800) 826-7652
30.	Schlage, Colorado Springs, CO	(800) 847-1864
31.	Securitech Group Incorporated, Maspeth, NY	(800) 622-5625
32.	Simplex Access Controls	(800) 746-7539
33.	Soss, Pioneer, OH	(800) 922-6957
34.	Stanley, New Britain, CT	(877) 334-6791
35.	Trimco, Los Angeles, CA	(323) 262-4191
36.	Von Duprin, Indianapolis, IN	(317) 613-8302
37.	Wooster Products Incorporated, Wooster, OH	(800) 321-4936
38.	Yale, Charlotte, NC	(800) 438-1951
39.	Zero International (Allegion), Indianapolis, IN	(877) 671-7011

D. Section 016000 - Product Requirements: Unless noted otherwise, substitution of specified products with equivalent products from the above approved manufacturers is permitted in accordance with Product Options and Substitutions in Section 016000.

2.2 HINGES

A. Subject to compliance with requirements, provide hinges of one of the following manufacturers and as specified below:
1. Hager.
2. McKinney.
3. Stanley.
4. Soss.

B. Material:
1. For interior doors, provide full mortise-type steel hinges with steel pins; non-rising for non-security exposure, flat button with matching plugs.
2. For exterior doors, provide full mortise-type stainless steel hinges with stainless steel pins; non-removable, flat button with matching plugs.
3. Ball-bearing Type: Swaged, inner leaf beveled, square corners.

C. Hinges/pivots by types:
1. Type H-1: Medium weight door, average frequency, steel.

a.	Hinge	FBB179	4-1/2 x 4-1/2	652	Stanley
b.	Hinge	BB1279	4-1/2 x 4-1/2	652	Hager
c.	Hinge	TB2714	4-1/2 x 4-1/2	652	McKinney

2. Type H-2: Medium weight door, average frequency, steel, non-removable pins. Hinges on interior doors shall be satin chrome plated finish 652. Hinges on exterior doors shall be completely stainless-steel finish 630.

a.	Hinge	FBB179	4-1/2 x 4-1/2 NRP	652	Stanley
b.	Hinge	BB1279	4-1/2 x 4-1/2 NRP	652	Hager
c.	Hinge	TB2714	4-1/2 x 4-1/2 NRP	652	McKinney

2.3 LOCKS, LATCHES, AND BOLTS

A. Subject to compliance with requirements, provide locks, latches and bolts of one of the following manufacturers and as specified below:
1. Best.
2. Corbin Russwin.
3. Sargent.
4. Schlage.
5. Yale.

B. Materials:
1. Mortise Locks: ANSI A156.13, Grade 1, equipped with 6-pin tumbler. Provide 2-3/4-inch backset. Provide three keys per cylinder.
2. Latch Sets: Provide release by turning lever, closing door, or turning emergency release key through hole in outside knob.
3. Strikes: ANSI Strikes, 1-1/4 x 4-7/8 inches, with curved lip. Wrought box strikes, with extended lip for latch bolts, except open strike plates may be used in wood frames. Provide dustproof strikes for foot bolts.

4. Tactile Warning: Provide lever handles with manufacturer's standard tactile warning per handicapped codes when required by local authority.

C. Keying
1. General:
a. Incorporate a security system to ensure that keys used during construction do not open doors after City of Torrance occupancy.
b. Key side of locks shall be on the public side.
c. Master and submaster key system shall conform to City of Torrance criteria. Other areas, based on need or local preference, may be excluded from master/submaster keying schedule.

2. Construction Keying:
a. Furnish exterior door lock sets with keyed alike removable construction core cylinders for use during construction.
b. Restrict distribution of construction keys. Maintain record of persons who have received keys and deliver copies of record to General Services Director or Designee upon request.
c. Provide permanent cores to Airport Manager prior to substantial completion. Airport Manager shall store them securely until needed. At substantial completion and at General Services Director or Designee direction, remove construction cores and replace with permanent cores in presence of Postmaster. Provide keys to City and return construction cores to manufacturer.

3. Permanent Keying:
a. Master locks and cylinders are to match the City of Torrance existing keying system if a system exists.

D. Cylinders and Thumbturns by types:

1.	Type B-1: Rim Cylinder.			
a.	Cylinder	1109	626	Yale
b.	Cylinder	20-022	626	Schlage
c.	Cylinder	3000-200	626	Corbin Russwin
2.	Type B-2: Mortise Cylinder.			
a.	Cylinder	2153 w/ 1161 series cam	626	Yale
b.	Cylinder	20-013	626	Schlage
c.	Cylinder	1000-A03	626	Corbin Russwin
3.	Type B-3: Cylinder Guard			
a.	Cylinder Guard	MS4043	630	Adams Rite

E. Locks and Latches by types:

1.	Type L-2 Classroom Lock (ANSI F84)		
a.	AU 5408LN	626	Yale
b.	CL 3555	626	Corbin Russwin
c.	ND70PD	626	Schlage
2.	Type L-3 Entrance Lock (ANSI F20)		
a.	AUR 8847FL w/security collar	626	Yale
b.	ML2067 w/ security collar	626	Corbin Russwin
c.	L9453P-06A w/ security collar	626	Schlage

2.4 PUSH/PULL UNITS

A. Pulls and Pushes Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. H. B. Ives.

2. Trimco.
3. Rockwood.
4. Baldwin.
5. Adams Rite

B. Materials: ANSI A156.6 for 0.050-inch thickness.

C. Push and Pulls by types:
1. Type P-1: Push 4-inch x 16 inch.
   a. 1001-3 630 Trimco
   b. 70C 630 Rockwood
2. Type P-2 Pull: 4-inch x 16 inch.
   a. 1010-3 630 Trimco
   b. 132 x 70C 630 Rockwood
3. Type P-3 Pull: 2.75-inch x 11.5 inch.
   a. 3001 fixed pull 629 Adams Rite

2.5 EXIT DEVICES

A. Exit Devices: Subject to compliance with requirements, provide exit devices of one of the following manufacturers and as specified below.
1. Corbin Russwin.
2. Yale.
3. Von Duprin.
4. Adams Rite.
5. Jackson Exit Device.
6. Monarch.
7. Sargent.
8. Securitech Group Inc.

B. Materials:
1. Provide exposed metal to match hardware.
2. Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure condition. Reinforce substrate as recommended.

C. Exit Devices by types:
1. Type E-10: Exit Device (F10) (for wood and metal doors)
   a. 8700 C36-US32D-MEC 628 Adams Rite
2. Type E-10A: Exit Device (F10) Double (for wood and metal doors)
   a. 8500 C36-32DMEC 628 Adams Rite

2.6 CLOSERS

A. Closers: Subject to compliance with requirements, provide closers of one of the following manufacturers and as specified below.
1. LCN.
2. Norton.
3. Yale.

B. Materials & Features:
1. ANSI A156.4, Grade 1.
2. ADA/ANSI A117.1

3. U.L. listed. Provide closers for fire rated openings in compliance with NFPA 80, NFPA 101, and local building codes.
4. Non-Sized; adjustable 1 to 5 pounds.
5. 180-degree door opening.
6. Heavy Duty parallel arm.
7. Standard Cover.
8. Provide exposed metal to match hardware.
9. Mounting: Mount closers as follows unless indicated otherwise:
   a. Interior side of exterior doors.
   b. Opposite side of public side.
   c. Workroom side of doors leading to or from the Workroom.
   d. Room side of corridor doors.
10. Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure condition. Reinforce substrate as recommended.
11. Closers to be installed to allow door swing as shown on drawings.

C. Closers by types:

1. Type C-1:

a.	4011	689	LCN
b.	P7500	689	Norton
c.	4400	689	Yale

2. Type C-2: Parallel arm.

a.	4111	689	LCN
b.	P7500	689	Norton
c.	4400	689	Yale

2.7 STOPS, HOLDERS AND BUMPERS

A. Stop and Holder, Floor and Wall Stop, and Bumper Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. H. B. Ives.
2. Quality Hardware Manufacturing Co., Inc.
3. Trimco.
4. Dor-O-Matic.
5. Glenn-Johnson.

B. Materials:
1. Door stop mounting: Methods to suit substrates encountered (plastic anchor, drywall anchor, expansion shield).
2. Provide grey rubber exposed resilient parts.
3. Do not furnish aluminum floor stops.
4. Where a door stop is specified in the Hardware Schedule, provide a wall stop type (S-1). However, if circumstances prevent a wall stop installation (door too far from perpendicular wall, door swing into adjacent glass, etc.) then substitute a type (S-2) or (S-3) floor stop as indicated for use intended.
5. Adjust height of floor stops to suit undercut of adjacent door.

C. D. Stops, Holders and Bumpers by types:

1. Type S-1: Wall Stop - Install with appropriate anchors for substrate encountered.

a.	1270W	630	Trimco
b.	407 1/2C	630	Ives

2. Type S-2: Floor Stop - Install with appropriate anchors for substrate encountered.

a.	1201	626	Trimco
b.	FS444	626	Ives

3. Type S-3: Floor Stop - Install with appropriate anchors for substrate encountered.

a.	W1211	630	Trimco
b.	FS436	630	Ives
c.	331ES	630	Quality

2.8 THRESHOLDS

A. Threshold Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. Pemko.
2. National Guard.
3. Reese.
4. Zero.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

C. Thresholds by types:
1. Type T-2:
Saddle threshold for floor finish at doors (either VCT to VCT or VCT to tile or sealed concrete.)

a.	VCT to VCT		
	154	628	Pemko
	HD5A	628	Reese
	425E	628	National
b.	VCT to Tile/Concrete		
	158	628	Pemko
	S514A	628	Reese
	653	628	National

2. Type T-3 (with weather seal):

a.	S483AV	628	Reese
b.	2005AT	628	Pemko
c.	896V	628	National

2.9 WEATHERSTRIPPING

A. Weatherstripping Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. Pemko.
2. Reese.
3. Zero.
4. National Guard.

B. Weatherstripping by types:
1. Type W-1: Door Gaskets.

a.	807A	Reese

2.10 MISCELLANEOUS HARDWARE

A. Miscellaneous Hardware Manufacturers: Subject to compliance with requirements, provide from the manufacturers specified below.

B. Provide door silencers for all doors unless indicated otherwise.

C. Miscellaneous Hardware by types:

1.	Type M-1: Acoustical Perimeter Door Seal		
	a. 105NA	628	National
2.	Type M-2: Dead Lock, (ANSI E0191) - w/ No exposed trim on lobby side.		
	a. 3300 Series	630	Yale
3.	Type M-3: Security Viewer. Mounted/installed, centered at 5'-0" AFF.		
	a. 1756	630	Hager
4.	Type M-4: Astragal		
	a. 184A	628	Reese
5.	Type M-5: Silencers		
	a. 1229A	Gray	Trimco
	b. SR64		Ives
6.	Type M-6: Flushbolts		
	a. 3917	626	Trimco
	b. 555	626	Rockwood
7.	Type M-7: Astragal		
	a. 276C	628	Reese
8.	Type M-8: Kick Plates		
	a. K0050 8 x 34	630	Trimco
	b. KP18 8 x 34	630	Rockwood
9.	Type M-9: Armor Plate; 40” H x 46” W (both sides of door)	630	
10.	Type M-11: Reinforcing Pivot Hinges		
	a. 253	652	Hager
11.	Type M-12: Bumper (Install on push side of door at same height as lockset, in line with lever handle of lockset and approximately 2 inches away from the handle.)		
	a. 170-19	630	Bommer
12.	Type M-13: Door Bottom Shoe		
	a. DES-3C, 1 ¼” x 1 ¾” width	630	Hiawatha

2.11 FABRICATION

A. Finish and Base Material Designations: Number indicate BHMA Code or nearest traditional U.S. commercial finish.

B. Where base material and quality of finish are not otherwise indicated, provide at least commercially recognized quality specified in applicable Federal Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify that doors and frames are ready to receive Work and dimensions are as instructed by the manufacturer.
   2. Verify that electric power is available to power operated devices and of the correct characteristics.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION

A. Where not specified under other sections to be performed by manufacturer or suppliers, machine, fit and drill wood and metal doors.

B. Prepare doors of various types to receive hardware, using templates and instructions provided with the hardware items for jobsite work.

C. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by General Services Director or Designee.

D. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

E. Installer of security hardware is to be trained and familiar with product.

F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

G. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.3 ADJUSTING

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct City of Torrance Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct City of Torrance personnel in recommended additions to the maintenance

procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE SCHEDULE

A. General requirements, see respective paragraphs above for details:
   1. Ensure that keys used during construction cannot open doors after City of Torrance occupancy.
   2. Provide door silencers for all doors unless indicated otherwise.

SET 1

EOC to exterior Single (CA101A)
Each set to have:

3 ea.	(H-2)	Hinges
1 ea.	(E-10)	Exit Device
1 ea.	(B-1)	Rim Cylinder
1 ea.	(B-2)	Mortise Cylinder
1 ea.	(B-3)	Cylinder Guard
1 ea.	(T-3)	Threshold
1 ea.		Closer

SET 2

EOC to GAC
Each set to have:

3 ea.	(H-2)	Hinges
1 ea.	(L-2)	Classroom Lock (F84)
1 ea.	(T-2)	Threshold
1 ea.	(M-3)	Security Viewer
1 ea.	(M-13)	Door Bottom Shoe
1 ea.		Door Stop
1 ea.		Closer

SET 3

Conference Room to EOC (106)
Each set to have:

3 ea.	(H-1)	Hinges
1 ea.	(L-2)	Classroom Lock (F84)
1 ea.		Door Stop
1 ea.		Closer

SET 4

EOC to Exterior Exit, Double (100A)
Each set to have:

6 ea.	(H-2)	Hinges
1 ea.	(T-3)	Threshold
2 ea.		Closer
2 ea.	(E-10A)	Exit Device
2 ea.	(P-3)	Fixed Pull
1 ea.	(B-1)	Rim Cylinder
1 ea.	(B-3)	Cylinder Guard
1 set	(W-1)	Door Gaskets
2 ea.	(M-6)	Flushbolts
1 ea.	(M-7)	Astragal
2 ea.	(M-13)	Door Bottom Shoe

END OF SECTION

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior non load-bearing steel stud framing and furring 20 gage and lighter.
   2. Metal furring.
   3. Wood blocking.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM C 645 - Specification for Non-Structural Steel Framing Members.
   3. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   4. ASTM C 954 - Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.

B. United States Department of Commerce Product Standard (PS):
   1. PS 20 - American Softwood Lumber Standard.

C. Southern Pine Inspection Bureau (SPIB):
   1. Grading Ru

D. Western Wood Products Association (WWPA):
   1. Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Product Data:
      a. Framing Members: Standard materials and finish, product criteria, sizes and lengths, load charts, and limitations.
      b. Fasteners and Anchorage Devices: Standard materials and finish, sizes, and load charts.
   2. Shop Drawings:
      a. Indicate prefabricated work, component details, framing layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
      b. Indicate methods of securing studs and framing to tracks, splicing, suspension, and for blocking and reinforcement to framing connections.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Store and protect metal framing with weatherproof covering, and ventilate to avoid condensation.

D. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with project requirements, alternate manufacturers offering specified items which may be incorporated in the Work include the following:
   a. Dale/Incor, Dearborn, MI (800) 882-7883.
   b. National Gypsum Company, Gold Bond Building Products, Charlotte, NC. (800) 628-4662.
   c. Clark Steel Framing Systems, Middletown, OH (800) 543-7140.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Interior Nonload-Bearing Partition Framing: ASTM A 653 and ASTM C 645; galvanized sheet steel, channel shaped, punched for utility access, depth as indicated on Drawings, gages as indicated below unless indicated on Drawings.
   1. 2-1/2 Inch Studs - Unbraced Length 13 Feet or Less: Minimum 20 gage.
   2. 3-5/8 Inch Studs - Unbraced Length 17 Feet or Less: Minimum 22 gage.
   3. 3-5/8 Inch Studs - Unbraced Length 18 Feet or Less: Minimum 20 gage.
   4. 6 Inch Studs - Unbraced Length 25 Feet or Less: Minimum 22 gage.
   5. 6 Inch Studs - Unbraced Length Greater Than 25 Feet: Minimum 20 gage.
   6. Limiting heights are for 5/8 inch thick gypsum board panels on each side of partition and 5 pounds per square foot uniform load perpendicular to partition.

B. Partition Floor Tracks and Runners: ASTM A 653 and ASTM C 645; galvanized sheet steel, channel shaped, same depth and gage as studs, tight fit; solid web.

C. Wall Furring and Partition Bracing: ASTM A 653 and ASTM C 645; galvanized sheet steel.
   1. Studs: 2-1/2 inch deep, 22 gage.
   2. Studs: 3-5/8 inch deep, 20 gage.
   3. Hat-Shaped Channels: 7/8 inch deep x 1-1/2 inch wide, 25 gage.

4. Cold-Rolled Channels: 3/4 x 1/2 inch and 1-1/2 x 17/32 inch, 16 gage.
5. Z Furring Channel: 1-1/2 inch deep, 25 gage.
6. Clip Angles: 2 inches x 2 inches x 16 gage x 1/4 inch less than stud width.

D. Partition Framing Fasteners: Corrosion-resistant self-drilling self-tapping steel screws.
1. 22 Gage Framing: ASTM C 1002; 3/8 inch Type S pan head.
2. 20 Gage and Heavier Framing: ASTM C 954; 5/8 inch Type S-12 low-profile head.

E. Partition Floor Track Anchorage Device: Low velocity powder-actuated drive pins; minimum 0.140 inch shank diameter x 1-1/2 inch shank length with 7/8 inch diameter washer.
1. DX 451 System using X-DNI Pins with R23 washers, by Hilti, Tulsa, OK. (800) 879-8000.
2. Ramset/Red Head System using 4700SD Pins, by ITW Ramset/Redhead, Wood Dale, IL (708) 350-1858.
3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

F. Wall Furring to Concrete or Masonry Wall Fasteners: Hex head sleeve anchors; minimum 1/4 inch diameter x minimum 1-1/8 inch embedment.
1. Slv Anch HX 5/16X2-1/2, by Hilti, Tulsa, OK (800) 879-8000.
2. Dynabolt HN-1413, by ITW Ramset/Redhead, Wood Dale, IL (708) 350-1558.
3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

G. Furring Channel to Masonry or Concrete Surface Fasteners: Low velocity powder-actuated drive pins of size to suit application.

H. Flat Straps and Plates: ASTM A 653; galvanized sheet steel, gage, shape, and configuration as indicated on Drawings.

I. Wood Blocking Attached to Partition Framing:
1. PS 20; S4S. Maximum of 19 percent moisture content, surfaced dry, No. 2 any species graded under WWPA grading rules or No. 3 Grade Southern Pine graded under SPIB grading rules.
2. Full sized, sound lumber without splits, warps, wane, or loose knots.

J. Security Mesh: 1/2 inch #16 galvanized carbon steel flattened expanded metal sheets or 22ga. sheet metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify that building framing components are ready to receive Work.
2. Verify that rough-in utilities are in-place and located where required.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION

A. Install studs and fasteners in accordance with manufacturer's published instructions and ASTM C 754.

B. Metal Stud Spacing: 16 inches on center, maximum.

C. Align stud web openings horizontally.

D. Splice studs with minimum 8 inch nested lap, fasten each stud flange with minimum two screws.

E. Construct corners using minimum three studs.

F. Double stud at wall openings and door jambs, maximum 2 inches from each side of openings.

G. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.

H. Install framing between studs for attachment of mechanical and electrical items.

I. Install intermediate studs above and below openings to match wall stud spacing.

J. Fasten studs adjacent to door frames, partition intersections, and corners to top and bottom runner flanges in double-stud fashion with metal lock fastener tools.
   1. Securely fasten studs to jamb and head anchor clips of door and borrowed-light frames.
   2. Place horizontally a cut-to-length section of runner with web-flange bend at each end, fasten with minimum one screw per flange.
   3. Position a cut-to-length stud (extending to top runner) at vertical panel joints over door frame header.

K. Blocking: Screw attach wood blocking between studs for support of surface mounted items.
   1. Plumbing fixtures.
   2. Toilet partitions.
   3. Wall cabinets.
   4. Toilet accessories
   5. Hardware.
   6. Architectural woodwork.
   7. Grab bars.
   8. Handrails and railings.
   9. Signage.
   10. Other items requiring backing for attachment.

L. Install batt insulation in walls, where indicated on Drawings, as specified in Section 072100.

M. Framing Fastening: Fasten framing in accordance with manufacturer's published instructions and schedule below, unless indicated otherwise on Drawings.

CONNECTION	FASTENER
Floor and Top Track to Concrete	1 - Pin at 32 inches on center.
Partition Stud to Floor Track	1 - Screw each side at each flange.
Plates and Straps to Studs	2 - Screws.
Stud Web to Stud Web	2 - Screws.
Runner to Header	1 - Screw at 16 inches on center, max. 6 inches from each end.

3.3 INSTALLATION - FURRING

A. Furring Channels:
   1. Attach vertically spaced at maximum 16 inches on center, to masonry and concrete surfaces with hammer set or powder driven fasteners staggered 24 inches on center on opposite flanges.
   2. Nest channels 8 inches at splices and anchor with 2 fasteners in each wing.

B. Wall Furring:
   1. Secure top and bottom runners to structure.
   2. Space metal studs at maximum 16 inches on center.

3.4 CONSTRUCTION

A. Interface with Other Work:
   1. Coordinate erection of studs at openings and with hollow metal door frames.
   2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.

B. Site Tolerances:
   1. Maximum Variation From True Position: 3 mm in 3 m.
   2. Maximum Variation From Plumb: 3 mm in 3 m.

3.5 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Inspect metal framing erection, placement, spacing, fasteners, and connections to building.

C. Inspect security mesh installation, fastener type, spacing, and attachment to metal framing.

END OF SECTION

SECTION 09 2423

CEMENT PLASTER AND METAL LATH

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lath and Portland cement plaster and stucco.

2. Lath and scratch coat of Portland cement plaster as a substrate for ceramic wall tile.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 3000 – Cast-in-Place Concrete.

3. Section 07 2100 – Thermal Insulation.

4. Section 07 2719 – Plastic Sheet Air Barriers.

5. Section 09 2216 - Non-Structural Metal Framing.

1.02 SYSTEM DESCRIPTION

A. Continuous Insulation Under Cement Plaster: Three coat 7/8” cement plaster with fiberglass reinforcing mesh on metal lath over rigid foam insulation with drainage channels over water resistive barrier over plastic sheet air barrier over sheathing over metal studs.

B. Continuous Insulation on Z Channels Under Cement Plaster: Three coat 7/8” cement plaster with fiberglass reinforcing mesh on metal lath over water resistive barrier over plastic sheet air barrier over rigid foam insulation mounted on steel Z channels with foam tape over sheathing over metal studs.

C. Three coat 7/8” cement plaster on metal lath over water resistive barrier over plastic sheet air barrier over sheathing over metal studs.

D. Two coat 1/2” to 5/8” cement plaster over concrete.

E. Two coat 1/2” to 5/8” cement plaster over concrete.

F. Soffits and ceilings: Three coat 7/8” cement plaster on metal lath over suspended metal framing.

G. One coat cement plaster base for ceramic tile installation.

1.03 REFERENCES

A. ASTM International (ASTM):

1. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.

3. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

4. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

5. ASTM C150 – Standard Specification for Portland Cement.

6. ASTM C206 – Standard Specification for Finishing Hydrated Lime.

7. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring.

8. ASTM C847 - Standard Specification for Metal Lath.

9. ASTM C897 – Standard Specification for Aggregate for Job Mixed Portland Cement-Based Plasters.

10. ASTM C926 – Standard Specification for Application of Portland Cement-Based Plaster.

11. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.

12. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

13. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

14. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

15. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.

16. ASTM E1190 – Standard Test Methods for Power-Actuated Fasteners Installed in Structural members.

B. Federal Specifications (FS):

1. FS FF-N-105: Nails, Brads, Staples and Spikes: Wire, Cut and Wrought.

2. UU-B-790A: Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).

C. International Code Council (ICC):

1. ICC-ES AC11: Acceptance Criteria for Cementitious Exterior Wall Coatings.

2. ICC-ES AC 191: Acceptance Criteria for Metal Plaster Bases (Lath).

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each material and component proposed for installation.

B. Plaster Samples: Submit minimum 48-inch by 48-inch samples of each stucco and Portland cement plaster texture for review. Samples shall be representative of texture, color, and proposed fabrication and finish quality. Maintain reviewed Samples on Project site for reference.

C. Accessories Samples: Submit 12 inch long samples of metal lath accessories: control joints, expansion joints, corner reinforcements, reveals and screeds.

D. Certificates: Submit test reports or ICC Evaluation Reports indicating that materials are in compliance with CBC requirements. Cementitious materials shall meet the acceptance requirements of ICC AC11, and metal lath the acceptance requirements of ICC AC191.

1.05 QUALITY ASSURANCE

A. Mock-ups:

1. Constructed separately from the building but on Project site.

2. Constructed as part of the building.

3. Provide a mock-up at least 10-foot wide by 10-foot high. Include at least one control joint and, corner condition and one window opening flashing. Locate where indicated by the ARCHITECT.

4. Mock-up shall be constructed by the same personnel who will be erecting the different components of the wall assembly on the project, overseen by the same personnel who will be acting as acting as supervisors during actual construction, and built with the same construction techniques and materials that will be used on the project.

5. Wall/window assembly will be tested by a lab retained by the OWNER for air and water infiltration in accordance to ASTM E1105 and ASTM E783.

B. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference in accordance to Section 01 3119, Project Meetings, to review the progress of construction activities and preparations for the installation of metal lath and cement plaster and other related work of this Section.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store weather sensitive materials under cover, off the ground, and kept in a dry condition until ready for use.

B. Deliver materials to the Project site in manufacturer's sealed and labeled packages.

PART 2 - PRODUCTS

2.01 METAL LATH AND WEATHER RESISTIVE BACKING

A. Metal Lath:

1. Walls and Ceilings: Diamond mesh expanded metal lath, in conformance to ASTM C847, without paper backing. 3.4 pounds per square yard, hot-dip galvanized coating G60 in accordance with ASTM A653. Alabama Metal Industries Corporation (AMICO), California Expanded Metal Products Company (CEMCO), ClarkDietrich, Marino-Ware, or equal.

a. V-grooved self-furring type for installation over sheathing. Lath shall be furred out a minimum of 1/4 inch when installed over a solid surface.

b. Flat type for installation over spaced framing.

2. Walls: Self-furring Welded Wire Lath: Weight 1.95 pounds per square yard, with Class 1 galvanized coating in conformance to ASTM A641. Structa Mega Lath per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

3. Walls & Ceilings: Self-furring Welded Wire Lath: Weight 2.2 pounds per square yard, with Class 1 galvanized coating in conformance to ASTM A641 with heavy perforated Kraft paper. V-Truss per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

B. Water Resistive Barrier Backing for Metal Lath:

1. One layer of air barrier membrane per Section 07 2719, Plastic Sheet Air Barriers.

C. Self-Adhered Flashing:

1. Compatible with the Plastic Sheet Air Barrier, minimum 25 mils thick, self-sealing and waterproof.

2. Adhesives, primers and sealers for self-adhered flashings and water repellant backing shall be as recommended by manufacturer for installation with specified products and substrates, and shall be approved by the Architect.

2.02 METAL LATH ACCESSORIES

A. Materials: Minimum 0.0172 inch galvanized steel or 0.0207 zinc alloy with expanded wings. PVC is not permitted. Furnish casing beads, expansion and control joints, weep and vent screeds.

B. Manufacturers: Alabama Metal Industries Corporation (AMICO), California Expanded Metal Products Company (CEMCO), ClarkDietrich, Stockton Products, Marino-Ware, equal.

C. Products:

1. Exterior Stress Relief Joints: Sizes and profiles, indicated or required. Control joints shall have expanded wings when attachment flange is installed above the primary water-resistant barrier.

2. Expansion Joints: Two piece sections designed to accommodate expansion, contraction and shear forces. Industry generic name: #40-2 piece joint.

3. Control Joints: One-piece sections, with flange designed to engage plaster. Grounds shall provide full 7/8 inch thickness of cement plaster. Industry generic name: XJ-15.

4. Soffit Drip Screed: Similar to Stockton Products No. 5, with key holes.

5. Casing Beads: Expanded or standard flange type with 7/8 inch grounds to establish plaster thickness. Industry generic names: J-Mold or # 66.

6. Welded Wire Corner Reinforcement: 2-5/8 inch wire wings square or bullnose. Industry generic name: CornerAid.

7. Inner Corner Reinforcement: Shaped reinforcing expanded metal with 3 inch legs, for angle reinforcement. Industry generic name: Cornerite.

8. Lath Reinforcement: Flat expanded metal lath reinforcing units. Industry generic name: Striplath.

9. Outside Corner Reinforcing: 2 1/2" legs Class 1 Galvanized Coating complying with ASTM A641. VTruss Straight Corner per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

10. Ventilating Screeds: Soffit, attic, fascia, edge, channel and expansion channel vent screeds, perforated web type, with integral plaster grounds, of sizes indicated on drawings.

11. Foundation Weep Screeds: Integral plaster ground and weep screed; 3-1/2” minimum attachment flange. Industry generic name: #7 Weep Screed.

12. Foundation Casing at Walls with Continuous Insulation: Custom shaped galvanized steel “J” mold with weep holes. Width shall be sized to accommodate insulation thickness plus 7/8 inch plaster.

2.03 LATH FASTENERS

A. Fasteners through Continuous Insulation: Fastener spacing as indicated on drawings.

1. Wood Studs: Fasteners shall be corrosion resistant.

   a. Nails: In accordance to FS FF-N-105, **[0.113 inch] [0.120 inch] [0.131 inch]** with a 3/8 inch diameter head with length that penetrates wood framing (exclusive of sheathing) 1-1/4 inch minimum.

   b. Lag Screws: 1/4 inch diameter with length that penetrates wood framing (exclusive of sheathing) 1-1/2 inch minimum.

2. Metal Studs: Corrosion resistant coated wafer head steel **[#8] [#10]** screws with length that penetrates framing steel thickness plus three threads minimum.

B. Fasteners at Locations with no Continuous Insulation:

1. Wood Studs: Fasteners shall be corrosion resistant.

   a. Nails: In accordance to FS FF-N-105, 0.113 with a 3/8 inch diameter head with length that penetrates wood framing (exclusive of sheathing) 3/4 inch minimum.

   b. Screws: Type A, in accordance to ASTM C1002, length that penetrates wood framing (exclusive of sheathing) 3/4 inch minimum.

   c. Staples: In accordance to FS FF-N-105. Minimum 3/4 inch crown, 0.053 inch steel. Staples shall have sufficient length to penetrate studs at least 3/4 inch.

2. Metal Studs: Wafer head type S or S-12, corrosion resistant, with length to penetrate framing steel thickness plus three threads minimum.

   a. Screws for fastening to steel members from 0.033 inch to 0.112 inch in thickness shall be in accordance to ASTM C954.

   b. Screws for fastening to steel members 0.033 inch in thickness and less shall be in accordance to ASTM C1002.

C. Fasteners for Concrete and CMU Substrates: Power Actuated Fasteners: For attachment of lath to concrete and concrete masonry, recommended by manufacturer for the specific use intended. Minimum 3/4 inch long hardened drive style pin with a 1/2 inch diameter style washer. Fasteners shall be Fasteners shall be corrosion resistant and provide minimum withdrawal resistance of 50 pounds minimum.

D. Wire: Wire for fastening lath to supports, tying ends and edges of lath sheets, and securing accessories to lath, 0.0475 inch diameter (# 18 wire). Galvanized soft-annealed steel wire in conformance to ASTM A641.

2.04 PLASTER MATERIALS

A. Factory Blended Portland Cement Plaster Basecoats and Finish: Products as fabricated by California Stucco, La Habra, Shamrock Stucco, Merlex, Omega Stucco, Inc., Expo Stucco, Spec Mix, Quikrete or other manufacturer member of the Stucco Manufacturer's Association (SMA).

1. Material Standards:

a. Portland Cement: ASTM C150.

b. Hydrated Lime: ASTM C206.

c. Sand: ASTM C897.

d. Fibers: ASTM C1116.

2. Three Coat Systems:

a. Scratch and Brown Coats: Factory blended fiber reinforced plaster and sand mix conforming to ASTM C926, and requiring only the addition of water. Total thickness of coats: 3/4 inch.

b. Finish Coat: Factory blended cementitious stucco color coat, integrally colored with fade-resistant pigments. Coat thickness 1/8 inch.

1) Finish: **Light Dash**

2) Color: As selected by ARCHITECT.

3. Two Coat Systems:

a. Brown Coat: Factory blended fiber reinforced plaster and sand mix conforming to ASTM C926, and requiring only the addition of water. Coat thickness 3/8 to ½ inch.

b. Finish Coat: Factory blended cementitious stucco color coat, integrally colored with fade-resistant pigments. Coat thickness 1/8 inch.

1) Finish: **Light Dash**

2) Color: As selected by ARCHITECT.

B. Water: Clean, potable and from domestic source.

C. Plaster Bonding Agent: In conformance to ASTM C932 and formulated for exterior use. "Weld-Crete", manufactured by Larsen Products Co., or equal.

D. Plaster Patching Materials:

1. Bonding Agent: Acrylic resin type, Acryl 60, LHP Bonder, or equal.

2. Patching Plaster: Manufactured by Merlex Stucco, Inc., or equal. Furnish fast setting, compatible with existing plaster materials, "Exterior Pronto Patch," Portland cement base coat material, requiring only addition of water. Material shall provide initial set within 20 minutes and final set within one hour.

E. Flashing: Single ply self-adhesive waterproofing membrane as manufactured by W.R. Grace Company, Jiffy-Seal by Protecto Wrap, W.R. Meadows, Inc., or equal. Furnish for installation

behind stress relief joints and backing on horizontal and vertical surfaces exposed to weather; under metal copings and flashings; and window jambs and sills.

F. Continuous Insulation: Refer to Section 07 2100, Thermal Insulation.

G. Miscellaneous Materials: Provide additional components and materials required for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that installation of plastic sheet air barrier and flashings, per Section 07 2719, and continuous insulation per Section 07 2100 are complete before starting Work of this Section.

3.02 INSTALLATION-OF WATER RESISTIVE BARRIER

A. Install one layer of water resistant barrier over air barrier. Install Kraft paper horizontally with each course weather lapped 2 inches over layer below and 6 inches on ends.

B. Repair and seal tears and holes in water resistive barrier prior to installing lath.

C. Install single ply self-adhesive flashing per manufacturer‘s recommendations in areas indicated on the Drawings and at locations where the plaster will be in less than a 60 degree plane or where water can pond, with a six inches extension onto the vertical wall surface. Apply self-adhesive flashing in a “shingle fashion”.

3.03 INSTALLATION OF LATH AND LATH ACCESSORIES

A. Exterior Lathing, General: Install in conformance to ASTM C1063 and CBC Chapter 25.

B. Install longest length of metal lath as possible. Do not use pieces shorter than six feet in length. Attach lath to framing supports not more than seven (7) inches apart along framing supports only.

C. Apply metal lath with long dimension at right angles to framing or furring supports and lap lath a minimum 1/2 inch at sides and minimum 1 inch on ends. Lap wire lath minimum one mesh on sides and ends. Stagger vertical laps at least 16 inches. Lath shall lap flanges of solid flanged trim accessories by a minimum of 50%.

D. Ends of lath on open framing (unsheathed) shall occur over supports. Where necessary, install additional studs to provide support for lath ends and support for separate flanges of stress relief joints.

E. Install trim accessories plumb, level and straight, attachments should not exceed 24 inches on center.

F. Lath shall not be continuous through control joints. Two-piece Expansion Joints shall have the lath cut, be attached to framing and lath lap the flanges. Place control joints as indicated on

elevations. Water resistant barrier shall be continuous behind all control joints and vertical reveals.

G. Install a weep screed at or below foundation plate line on exterior stud walls in conformance to CBC section 2512. Screed shall be of a type permitting water to drain to exterior of building. Weather-resistant barrier and exterior lath shall cover and terminate on attachment flange of screed.

H. Powder Actuated Fasteners shall be used on concrete/masonry substrates when lath is applied. Fasteners shall be driven home and avoid spalling of concrete. Pattern shall simulate that of framed walls.

I. Interior Lathing, General: Install in conformance to ASTM C841 and CBC Chapter 25.

J. Metal lath shall be fastened to metal supports with specified fastener spaced not more than 6 inches apart or with other recognized fasteners.

3.04 PLASTER APPLICATION - GENERAL

A. Verify that installation of lath is complete prior to start plastering. Notify the Architect upon completion of lath and prior to start of plaster to schedule a lathing installation compliance meeting. TSIB will submit a written field observation report delineating any deficiencies. Site meeting shall be coordinated with General Services Director or Designee.

B. Proportion, mix, apply, and cure plaster in conformance with ASTM C926 and CBC Chapter 25.

C. Install each plaster coat to an entire wall or ceiling panel without interruption to avoid cold joints and abrupt changes in uniform appearance of succeeding coats. Wet plaster shall abut existing plaster at naturally occurring interruptions in plane of plaster (such as corner angles, openings and control joints) wherever possible. Cut joining, where necessary, square and straight and at least 6 inches away from a joining in preceding coat.

D. Provide sufficient moisture or curing methods to permit continuous and complete hydration of cementitious materials, considering climatic and Project site conditions. If water cured, each basecoat shall be continuously damp for at least 48 hours, including weekends and holidays. Other curing methods, spray applied curing compounds, or other approved equal are permitted.

E. Provide sufficient time between coats to permit each coat to cure or develop enough rigidity to resist cracking or other damage when next coat is installed.

3.06 EXTERIOR PLASTERING

A. Concrete surfaces, except where noted as "Exposed Concrete" or "Painted Concrete," shall be finished with stucco **light dash** finish coats, as specified.

B. Preparation of Concrete and Masonry Surfaces:

1. Exterior concrete and masonry surfaces to be plastered shall be free of oily or waxy substances, and loose or foreign material. Uniformly spray with nozzle-type water spray at least 12 hours before installation of plaster or as required to control suction.

2. Concrete and masonry surfaces to receive two coat application of 5/8 inch thick Portland cement plaster shall be treated with bonding agent. This surface preparation shall not be installed instead of a brown coat of plaster.

3. Concrete surfaces to receive stucco dash finish shall be lightly sandblasted to provide a roughened surface.

4. Verify that lath has been installed securely and that grounds, screeds, casing beads and other accessories are straight, in correct position, and securely fastened in place.

C. Mixing: Provide plaster mix: cementitious materials and aggregate in proportions specified, furnishing only sufficient water to obtain proper consistency before installation. Do not mix any more material at any time than can be installed within 1/2 hour after mixing. Do not re-temper. Add only enough water to allow proper application of cement plaster.

D. Application:

1. **Dash** Bond Coat: on concrete or masonry surfaces, leave undisturbed, and maintain damp for at least 24 hours following installation. Dash bond coat may be omitted when liquid bonding agent is used.

2. Scratch Coat: Install with sufficient material to completely cover laths and scratch across supports.

3. Brown Coat: Rod to a straight, true, even within 1/4 inch tolerance in 5 feet of surface and consolidate surface with a wood or neoprene float. Surface shall be left open and course, suitable to receive finish coat.

4. Stucco Finish Coat: Install in two coats to a total thickness of 1/8 inch, each coat covering surface uniformly. First coat shall completely cover basecoat with uniform color. Second color shall provide a uniform texture.

    a. First coat shall be installed adequately to cover surface and fill minor imperfection in the brown coat.

    b. The second coat shall be installed by doubling back same day, when first coat is sufficiently dry.

    c. Over concrete surfaces, second coat shall be installed 24 hours after installation of first coat. In warm weather, first coat shall be cured by light water spray after material has set.

    d. Protection: Protect those surfaces, which are not to receive dash finish coats. Such surfaces shall be shielded and shall have any sand left from dashing operation removed.

    e. Provide smoothed plaster finish to comply with ADA requirements behind handrails.

E. Curing Exterior Plaster: Adhere to current edition of CBC for curing requirements.

F. Option for Machine Application, Scratch and Brown Coats: Instead of hand installed plaster, the furnishing of plastering machines for interior or exterior scratch and brown coats or single base coat is permitted. Machine installation shall be in accordance with the following:

1. Qualifications: Provide proper equipment and apparatus.

2. Apparatus: Pump shall be equipped with an air pressure gage or factory installed blow-off valve and required safety devices. Hoses and connections shall be tight and pressure shall be maintained constant.

3. Proportion and Application: Proportioning, mixing, number of coats and thickness shall be same as specified for hand application. Cement aggregate and water shall be mixed to plaster machine. Plaster mix shall be projected into and conveyed through a hose to the nozzle at end of hose and deposited by pressure in its final position ready for manual straightening and finishing.

4. Follow-Up: Perform scoring operation of plaster, based on settings and drying conditions at time of installation. Curing shall be as previously specified.

5. Protection: Before installing any plaster, thoroughly protect other adjacent Work.

3.07 INTERIOR PLASTERING

A. Portland Cement Plaster, Scratch Coat: Install to vertical lathed surfaces where ceramic tile is indicated, and install Portland cement plaster finishes where indicated.

B. Preparation for Plastering:

1. Verify that lath has been installed securely and that grounds, screeds, casing beads and other accessories are straight, in correct position, and securely fastened in place.

2. Bonding Agent: Install to vertical concrete or masonry surfaces to receive ceramic tile.

3. Concrete and masonry surfaces on which suction must be reduced shall be sufficiently moistened before plastering operations start.

4. Install galvanized expanded metal lath on supports in conformance with requirements of ASTM C1063 and CBC.

C. Number of Coats and Thickness: Interior plastering to receive paint shall consist of the following, with thickness measured from face of supports or surface:

1. On Concrete or Masonry: two coats, brown and finish, 5/8 inch thick.

2. On Metal Lath: three coats, scratch, brown and finish 7/8 inch thick.

D. Proportions for Interior Plaster: Adhere to current edition of CBC for proportions and curing requirements.

1. Admixtures shall be proportioned, mixed and installed in accordance with printed directions of manufacturer.

E. Mix factory blended plaster using only sufficient water to obtain proper consistency before installation. Do not mix any more material at any time than can be installed within ½ hour after mixing. Do not allow material to remain in mixer or mixing boxes overnight.

F. Application:

1. Dash Bond Coat: Dash on surface, leave undisturbed, and maintain damp at least 24 hours following installation. Omit Dash bond coat when liquid bonding agent is used.

2. Scratch Coat: Install with sufficient material to form good keys, thoroughly cover lath, and cross scratch.

3. Brown Coat: Rod to a straight, true and even surface. Brown coat must be 1/16 inch below face of grounds to provide adequate space for finish coat. Float surface to increase density.

4. Smooth Finishes: Install two coats for a thickness of 1/8 inch. Install second coat after finish coat begins to set. Install to a true, even plane and trowel to a smooth finish, free from blemishes.

5. Float Finishes: Install to a thickness between 1/16 inch to 1/8 inch, install and uniformly float to true planes.

6. Plaster Screeds: On metal lath or wire fabric lath, install plaster screeds wherever permanent grounds are too far apart to serve as guides for rodding.

G. Curing Interior Plaster: Adhere to requirements of CBC.

3.08 QUALITY CONTROL

A. Finish interior and exterior plaster to a uniform texture, free of imperfections and flat within 1/4 inch in 5 feet. Form a suitable foundation for paint and other finishing materials. Avoid joining marks in finish coats.

3.09 REPAIR OF DAMAGED PLASTER

A. Plaster Detached from Framing:

1. Remove loose and broken plaster.

2. Repair or replace damaged water-resistant backing and lath in compliance with specified standards.

3. Remove stucco finish from surrounding area in the same plane by sandblasting.

4. Install a scratch coat and a brown coat mixed with liquid bonding agent instead of water to the areas devoid of plaster.

5. Install a coat of liquid bonding agent to entire wall plane.

6. Install a 1/8 inch thick stucco finish coat to entire wall plane and match existing texture and color.

B. Cracked Plaster 1/8 inch to 1/2 inch:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of stucco and liquid bonding agent.

3. Install a coat of liquid bonding agent to entire wall plane.

4. Install 1/8 inch thick stucco finish to entire wall plane and match existing texture and color.

C. Cracks Larger than ½ inch - Painted:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of one part Portland cement to three parts masonry or stucco sand and liquid bonding agent to match existing texture of adjacent surface.

3. Paint entire wall plane, color to match existing.

4. Where patching of plaster over existing lath is feasible, fasten loose lath and install new lath with nails at 6 inch centers. Where metal is furnished, lap new lath over existing 6 inches and tie at 6 inch centers. Install paper backings as required, shingled into existing.

5. Patching of Holes, Cracks, and Gouges: Holes, cracks, gouges, missing sections, and other defects in existing improvements shall be patched. For holes over 1 inch in size, cut small sections of lath and place in opening attached to existing material. Install 3 coats of plaster. For holes one inch and smaller, install bonding agent to existing surfaces and neatly fill hole with plaster, installing necessary coats to match adjacent surfaces, eliminate cracks and match existing surface texture. Cracks, gouges, and other defects shall be filled with plaster or spackle as required and neatly finished to match adjacent existing improvements.

3.10 CLEANING

A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum board and joint treatment.
   2. Finishing.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 09 2216 - Non-Structural Metal Framing: Metal framing for attachment of gypsum board.
   2. Section 09 9100 - Painting: Field paint finish on gypsum board.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C36 - Specification for Gypsum Wallboard.
   2. ASTM C79 - Test Method for Gypsum Sheathing Board.
   3. ASTM C557 - Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
   4. ASTM C630 - Specification for Water-Resistant Gypsum Backing Board
   5. ASTM C954 - Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.
   6. ASTM C1002 - Specification Steel Drill Screws for the Application of Gypsum Panel Products.
   7. ASTM C1177 - Specification for Glass Mat Gypsum Substrate for Use As Sheathing.
   8. ASTM C1178 - Specifications for Glass Mat Water Resistant Gypsum Backing Panel.
   9. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   10. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association (GA):
   1. GA-214 - Recommended Levels of Gypsum Board Finish.
   2. GA-216 - Application and Finishing of Gypsum Board.
   3. GA-253 - Application of Gypsum Sheathing.
   4. GA-600 - Fire Resistance Design Manual.

1.3 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   a. Product Data: Data on gypsum board, joint materials, and finish materials.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.

2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

C. Stack gypsum board flat to prevent sagging.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Jobsite Requirements:
1. Establish and maintain environmental conditions for applying and finishing gypsum board in conformance with GA-216.
2. Maintain minimum 50 degrees F for 48 hours before application and finishing of gypsum board. Maintain temperature continuously until dry. Do not exceed 95 degrees F when using temporary heat sources.
3. Ventilate building spaces as required to dry joint treatment materials. Prevent drafts during hot, dry weather to avoid finishing materials from drying too rapidly.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Resource Management:
1. Recycled Content: Provide gypsum board products with paper backing manufactured from 100 percent post-consumer recycled paper and gypsum core containing minimum 10 percent recycled gypsum.
   a. Soil amendment from recycled scrap gypsum: Coordinate with Section 329200 - Turf and Grasses to identify requirements for gypsum soil amendment and to prepare scrap gypsum board for use as soil amendment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Georgia-Pacific Gypsum Products, Atlanta, GA (800) 225-6119.
2. National Gypsum Company, Gold Bond Building Products, Charlotte, NC (800) 628-4662.
3. United States Gypsum Company, Chicago, IL (800) 874-4968.
4. Allied Stud Co., Phoenix, AZ, (800) 877-8823.
5. Consolidated Fabricators Corp., Paramount, CA, (800) 635-8335
6. Steeler, Inc., Seattle, WA (800) 275-2279
7. Western Metal Lath, Inc., Riverside, CA (909) 360-3500

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Moisture-Resistant Gypsum Backing Board: ASTM C630; 1/2 and 5/8 inch thick, 48 inch width, maximum permissible length; ends and edges straight and solid, edges tapered. Board consisting of a noncombustible moisture-resistant gypsum core, surfaced on face and back with moisture-repellent paper bonded to the core.

B. Exterior Soffit Board: ASTM C1396; 1/2 and 5/8 inch thick, 48 inch width, maximum permissible length; ends and edges straight and solid, edges tapered. Board consisting of a noncombustible extra resistance to sagging and moisture gypsum core, surfaced on face and back with resin coated paper bonded to the core.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

E. Design non-axial load-bearing framing to accommodate 1/2 inch (13 mm) vertical deflection.

3.2 INSTALLATION

A. Install gypsum board in accordance with manufacturer's published instructions, GA-201 and GA-216.

B. Where applicable, install ceiling panels before the installation of wall panels.

C. Where applicable, install wall or ceiling panel patches flush over any openings left over from the construction process and from removed and not reinstalled items. Examples include, but not limited to: fixture backing plates, toilet partition anchors, modifications for plumbing, removed recessed toilet accessories, relocated recessed toilet accessories, mechanical grills, electrical items, etc. not shown on drawings. Provide blocking where necessary to support wall panels.

D. Erect single layer gypsum board in most economical direction, with attachment to firm bearing surfaces over framing members. Do not align panel joints with edges of openings.

E. Treat cut edges, holes, fastener heads and joints, including those at angle intersections, in water resistant gypsum board and exterior gypsum soffit board with specified joint compound. Treat cut edges, holes, fastener heads and joints in water resistant glass mat embedded backing board with mastic or mortar. Treat prior to tile installation.

F. Place gypsum panels over supporting framing members with panel ends aligning and parallel with framing members.

G. Install fasteners from center of field of panel toward ends and edges. Install fasteners 3/8 inch from ends and edges of panels, and as follows:
   1. Ceiling: 12 inches on center, perimeter and field.
   2. Walls: 16 inches on center, perimeter and field.

3.3 GYPSUM SHEATHING INSTALLATION

A. Install gypsum board sheathing in accordance with manufacturer's published instructions, GA-216, GA-253 and GA-600, all latest editions.
   1. Erect single layer gypsum board horizontally, with edges butted tight, tongue up with attachment to firm bearing. Glass mat embedded board may be installed horizontally or vertically.

B. Provide construction control joints at maximum 30 feet on center, at inside corners, and at intersections.
   1. Locate panel, allowing 1/4 inch space between edge of panel and adjacent walls, beams, columns, and fascia construction.

C. Place edge trim where gypsum board abuts dissimilar materials. Use longest practical length.

D. Using screws, secure panels in place at maximum 12 inches on center to supporting substrate.

E. Protect all exposed gypsum core at perimeter edges, and penetrations by covering core with metal trim.

3.4 JOINT TREATMENT

A. Reinforce interior and exterior corners at ceiling and wall surfaces. Apply 3 inch wide initial coating of joint compound, pressing tape firmly into joint compound. Wipe off excess joint compound. Apply second coat of joint compound with tools of sufficient width to extend beyond joint center, approximately 4 inches. Draw joint compound down to a smooth even plane.

B. After drying or setting, sand or sponge joints, edges, and corners, eliminating high spots and excessive joint compound to produce smooth finish surface. Prepare surfaces to receive subsequent finishes to height of 6 inches above finish ceiling. Feather coats onto adjoining surfaces resulting in maximum camber of 1/32-inch in 12.

C. Sand after second and third applications of joint compound. Do not to raise nap of paper when sanding.

D. Install control joints full height of partition, consistent with lines of building spaces, with 1/2 inch between boards. Apply sealant at base of joint and control joint accessory piece at face.

E. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.5 FINISH

A. Apply gypsum board finish in accordance with manufacturer's published instructions and GA-214 Finish Levels.
   1. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Prepared surface shall be coated with a drywall primer/sealer prior to the application of finish paint. Refer to specification section 099100.

a. Application: For use where gloss semi-gloss, enamel, or nontextured flat paints are specified or where severe lighting conditions occur. Generally in all areas except where noted otherwise.

3.6 CONSTRUCTION

A. Interface with Other Work:
1. Coordinate installation of firestopping Specified in Section 078400 at penetrations through fire-restive rated gypsum board partitions.
2. Coordinate installation of joint sealers specified in Section 079200 at penetrations of non fire-restive rated partitions.

END OF SECTION

SECTION 09 9100

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface preparation and field application of paints and finishes for interior and exterior surfaces.
   2. Schedule of Items to be painted.
   3. Interior painting and finishing schedule.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 3300 - Submittals: Procedures for submittals.
   1. Product Data: Submit product data for each type of paint specified.
      a. Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content.
      b. Painting Schedule listing surfaces to be painted with cross reference to the specific painting and finishing system and application. Identify each paint material by manufacturer's catalog number and general classification.
   2. Samples: Submit color brush-out sample for each paint color and sheen specified.
      a. Three samples on 8 1/2 inch x 11 inch card stock for color and sheen verification.
      b. Identify each sample by paint manufacturer, paint type, color, and sheen.
   3. Assurance/Control Submittals:
      a. Test Reports: Submit manufacturer's Material Safety Data Sheets (MSDS) for each paint type proposed.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing Work of this Section with minimum five years documented experience.

B. Regulatory Requirements:
   1. Surface Burning Characteristics in Accordance with ASTM E-84 for Class I or A finish:
      a. Flame Spread (Non-Combustible Surfaces): Less than 25.
      b. Smoke Density (Non-Combustible Surfaces): Less than 450.
   2. Provide paint and coating materials that conform to Federal, State, and Local restrictions for Volatile Organic Compounds (VOC) content.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time , cleanup requirements, color designation, and instructions for mixing and/or reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.

D. Prevent fire hazards and spontaneous combustion.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:
1. Apply paint finishes only when moisture content of surfaces is within manufacturer's acceptable ranges for type of finish being applied.
2. Surface temperatures or surrounding air temperature to be above 40 degrees F before applying alkyd finishes; above 45 degrees F for interior latex, and 50 degrees F for exterior latex work. Minimum for varnish and transparent finishes is 65 degrees F.
3. Provide continuous ventilation and heating facilities to maintain temperatures above 45 degrees F for 24 hours prior to, during and 48 hours after application of finishes.
4. Do not apply paint in areas where dust is being generated.
5. Provide lighting level in areas being painted of 80 foot candles measured mid-height at substrate surface.

1.7 MAINTENANCE

A. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Extra Materials:
1. Provide one gallon of each color, type and sheen to General Services Director or Designee.
2. Label each container with color, type, texture, room locations, in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the work include the following:
1. Benjamin Moore and Company, Montvale, NJ (201) 573-9600.
2. Duron Paints and Wall Coverings, Beltsville, MD (800) 723-8766.
3. Devoe (ICI), Cleveland, OH (888) 681-6353.
4. Glidden (ICI), Cleveland, OH (888) 681-6353.
5. Frazee Paint Company, Los Angeles, CA (800) 826-9048.
6. Pittsburgh Paints, Pittsburgh, PA (800) 441-9695.
7. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Paints:
1. Manufacturer's "Best Grade" for each type specified.
2. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture.
3. Providing good flowing and brushing properties and be capable of drying or curing free of streaks or sags.
4. VOC limits (g/L) for exterior and interior paint applications:

a. Exterior- Steel-Shop Primed
   1) Top Coat – Non-Flat: 150
   2) Top Coat - Gloss: 250
b. Exterior- Steel - Galvanized
   1) Primer Coat: 200
   2) Top Coat - Non-Flat: 150
   3) Top Coat - Gloss: 250
c. Interior Wood – Transparent
   1) Stain: 250
   2) Varnish: 350
d. Interior Concrete, Concrete Block
   1) Block filler: 300
   2) Top Coat – Flat: 100
   3) Top Coat – Non-Flat: 150
   4) Top Coat – Gloss: 250
e. Interior Steel – Unprimed
   1) Rust Prime Coat: 400
   2) Top Coat – Non-Flat: 150
   3) Top Coat – Gloss: 250
f. Interior Steel – Primed
   1) Top Coat – Flat: 100
   2) Top Coat – Non-Flat: 150
   3) Top Coat – Gloss: 250
g. Interior Steel – Galvanized
   1) Top Coat – Non-Flat: 150
   2) Top Coat – Gloss: 250
h. Interior Plaster, Gypsum Board
   1) Undercoater: 200
   2) Top Coat - Flat: 100
   3) Top Coat – Non-Flat: 150
   4) Top Coat – Gloss: 250

B. Primers and Undercoaters: Manufactured by same manufacturer as finish coat materials.

C. Paint Accessory Materials: Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified of high quality and approved manufacturer.

2.3 INTERIOR PAINT SYSTEMS

A. Benjamin Moore:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer: 284 Moorecraft Superhide Interior Latex Primer/Undercoater; MDF 1.5 mils.
   b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
2. Masonry: Eggshell, Water Base, Acrylic Latex.

a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.

3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
4. Wood: Satin, Water Base, Acrylic Latex.
   a. Primer: 253 Moorecraft Latex Enamel Undercoater and Primer Sealer; 2.0 mils.
   b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
   b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
   b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Enamel Undercoater: Moorecraft Acrylic Latex Underbody 269.
   b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.

B. Duron:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer: Interior Latex Drywall Primer 04-124: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm). (MPI 50, Approved)
   b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.(MPI 44, Approved)
2. Masonry: Eggshell, Water Base, Acrylic Latex.
   a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
   b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36Series; MDF 1.4 mils. (MPI 44, Approved)
3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
4. Wood: Satin, Water Base, Acrylic Latex.
   a. Primer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6mils. (MPI 50, Approved)
   b. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
   b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Dura Clad Universal Acrylic Metal Primer, White 33-015; MDF x.x mils. (MPI 76, Approved)
   b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer/Sealer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6 mils.(MPI 50, Approved)
   b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.

C. Devoe (ICI):
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer: Wonder-Tones Primer DR50801; MDF 1.5 mil.
   b. Each Finish Coat: Wonder-Tone Eggshell Enamel DR34XX, MDF 1.5 mil.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
   a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF.
   b. Each Finish Coat: Wonder-Tone Eggshell Latex Enamel DR34XX; MDF 1.5 mil.

3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX; MDF 1.5 mil.
4. Wood: Satin, Water Base, Acrylic Latex.
   a. Primer: Wonder-Prime DR51701.
   b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
   a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF.
   b. Each Finish Coat: Mirrolac W/B Semi-Gloss Latex Enamel DP83XX; MDF 1.5 mil.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
   a. Primer: Mirrolac W/B DTM Primer DP85XX; MDF 1.5 mil.
   b. Each Finish Coat: Mirrolac W/B Semi-Gloss DP83XX; MDF 1.5 mil.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
   a. Primer/Sealer: Wonder-Prime DR51701.
   b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.

D. Frazee:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer :063 PVA Aqua Seal Drywall Vinyl Primer Sealer; MDF 1.4 mils.
   b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
   a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
   b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
4. Wood: Satin, Water Base, Acrylic Latex.
   a. Primer: 172 Grip N Seal Enamel Undercoater; MDF 2.2 mils.
   b. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
   b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: 661F774 Metal Prime Alkyd Metal Primer; MDF 1.7 mils.
   b. Each Finish Coat: 123 Satin Glide Semi-Gloss Enamel; MDF 1.7 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer/Sealer: 172 Grip N Seal Enamel Undercoater MDF 2.2 mils.
   b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.

E. Glidden(ICI):
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer: ProMaster Interior Latex Primer-Sealer MP-5111; MDF 1.5 mil.
   b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
   a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF 11 mil.
   b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: Devflex 4214HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
4. Wood: Satin, Water Base, Acrylic Latex; MDF 1.5 mil.
   a. Primer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
   b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.

5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF11 mil.
   b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Devflex 4020 PF Direct to Metal Primer & Flat Finish; MDF 1.5 mil.
   b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer/Sealer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
   b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.

F. Pittsburgh:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
   a. Primer: 6-2 Speedhide Latex Sealer; MDF 1.0 mils.
   b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
   a. Primer: 6-7 Speedhide Block Filler; MDF 10.2 mils.
   b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
3. Metal: Satin, Water Base, Acrylic Latex.
   a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
4. Wood: Satin, Water Base, Acrylic Latex.
   a. Primer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
   b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: 6-7 Speedhide Block Filler; MDF 10.2 mils.
   b. Each Finish Coat: 6-500 Speedhide Semi-Gloss Latex; MDF 1.2 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer/Sealer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
   b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.

G. Sherwin Williams:
1. Gypsum Board: Low VOC, Eg-shell, Water Base, Acrylic Latex.
   a. Primer: Harmony Latex Primer, MDF 1.6 mils.
   b. Each Finish Coat: Harmony Latex Eg-Shel, MDF 1.6 mils.
2. Masonry: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils.
   b. Two Finish Coats: ProMar 200 Interior Latex Egg Shell: MDF 1.5 mils.
3. Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
4. Wood: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: PrepRite Classic Primer, B28W101, MDF 1.6 mils.
   b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils.
   b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer: Pro-Cryl Universal Water Based Primer, B66-310, MDF 3.0 mils.
   b. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
   a. Primer/Sealer: PrepRite Classic Latex Primer, B28W300, MDF 1.6 mils.

b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, and conditions otherwise detrimental to formation of a durable paint film.

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's published instructions for each particular substrate condition.
1. Provide barrier coats over incompatible primers or remove and reprime as required.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted or provide surface applied protection prior to surface preparation and painting operations. Reinstall all removed items after completion of paint work.
3. Clean surfaces to be painted before applying paint of surface treatment. Remove oil and grease prior to mechanical cleaning.

C. Ferrous Metals: Clean ferrous surface that are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
1. Touch-up shop-applied prime coats, where damaged or bare. Clean and touch-up with same type shop primer.

D. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent. Apply coat of etching primer if required by paint manufacturer.

E. Cementitious Materials: Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests.
   a. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct condition before application of paint.
2. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.
3. Clean floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.

F. Wood: Clean wood surfaces to be painted of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes, and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
   1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends faces, undersides, and backsides of such wood, including cabinets and counters.
   2. Seal tops, bottoms, and cut-outs with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

3.3 APPLICATION

A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.

B. Apply each coat slightly darker than preceding coat unless otherwise approved by General Services Director or Designee. Sand lightly between coats to achieve specified finish.

C. Do not apply finishes on surfaces that are not dry.

D. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer.

E. Apply additional coats when undercoats, stains, or other conditions show through final coat until paint film is of uniform finish, color, and appearance. Surfaces, including edges, corners, crevices, welds, and exposed fasteners to receive minimum dry film thickness equivalent to that of flat surfaces.

F. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate. Provide minimum dry film thickness (MDF) of the entire coating system as indicated in Painting and Finishing Schedule at end of this Section.

G. Block Fillers: Apply block fillers to concrete masonry units at rate to provide complete coverage with pores filled.

H. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by manufacturer to material scheduled to be painted or finished that has not been shop primed. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.

J. Hollow Metal Doors: Paint each door edge.

K. Completed Work: Match General Services Director or Designee approved field samples for color and sheen.

3.4 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Inspect painting and coating application for scheduled material, color, sheen, specified thickness (MDF), and coverage.

3.5 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.

B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. Upon completion of work leave premises neat and clean.

3.6 PROTECTION

A. Protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

3.7 COLOR SCHEDULE

A. See Drawings for color schedule.

3.8 SCHEDULE OF ITEMS TO BE PAINTED

A. Painted finishes shall be provided for, but not limited to, the following items. Refer to Drawings and Paint Color Schedule above for designated finishes and colors of areas.
   1. Interior: All interior surfaces as scheduled on Drawings including, but not limited to:
      a. Hollow metal doors and frames.
      b. Hollow metal window frames.
      c. Metal opening frames and trim.
      d. Gypsum wallboard.
      e. Exposed concrete unit masonry.
      f. Pipe Bollards.
      g. Metal railings.
      h. Exposed structure columns.
      i. Exposed wood trim.

B. Do not paint the following items:

   1. Pre-finished items:
      a. Aluminum, brass, bronze, stainless steel, and chrome plated steel.
      b. Pre-finished items, such as toilet compartments, acoustical ceiling materials, mechanical, and electrical equipment.
      c. UL, FM, and other code-required labels.
      d. Equipment identification, performance rating, and name plates.
      e. Finish hardware.
      f. Factory finished metal wall panels, metal wall panel trim, and metal gravel stops.

2. Exposed items:
    a. Exposed mechanical ductwork, hangers, and supports.
    b. Exposed piping and conduit, hangers and supports.
    c. Exposed fire protection piping, hangers and supports.
    d. Exposed roof structure.
    e. Exposed roof deck.

3.9 PAINTING AND FINISHING SCHEDULE

A. Interior Paint Systems:
    1. Interior Gypsum Wallboard:
        a. 1 coat Latex Wall Primer.
        b. 1 coat Latex Eggshell Enamel
    2. Interior Masonry:
        a. 1 coat Latex Block Filler
        b. 1 coat Latex Eggshell Enamel
    3. Interior Metal:
        a. 2 coats Latex Satin
    4. Interior Wood (painted):
        a. 1 coat Enamel Undercoat
        b. 2 coats Alkyd Semi-Satin Enamel
    5. Cast-In-Place Concrete:
        a. One coat of Latex Masonry Block Filler.
        b. Two tinted coats of Acrylic Latex Semi-Gloss Enamel.
    6. Wood Doors - Painted.
        a. One coat Enamel Undercoat.
        b. Two tinted coats of Latex Semi-Gloss Enamel.
    7. Ferrous Metals
        a. Touch up Prime Coat.
        b. Two tinted coats of Alkyd Enamel Semi-Gloss.
    8. Wood Cabinets, Shelves, etc. - exposed surfaces.
        a. One coat Primer-Sealer.
        b. One coat Enamel Undercoat.
        c. One coat Alkyd Enamel Semi-Gloss Enamel.

END OF SECTION

SECTION 101414

MISCELLANEOUS SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous building signage.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Shop Drawings:
      a. Indicate sign styles, lettering font, foreground and background colors, locations, and overall dimensions of each sign.
      b. Setting details for installation in concrete footings.
   2. Samples: Submit two sample signs 12 inches (30 cm) x 12 inches (30 cm) in size illustrating type, style, letter font, and colors specified; method of attachment.
   3. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
      b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
      c. Manufacturer's Instructions: Include installation template, attachment devices, and procedures for care of finished surfaces.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials to project site in manufacturer's original unopened protective packaging.

C. Identify contents, manufacturer, brand name, thermal values, and applicable standards.

D. Store in original packaging, off the ground and under protective covers.

E. Handle so as to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. APCO, Atlanta, GA (404) 688-9000.
   2. ASI Sign Systems, Incorporated, Dallas, TX (800) 274 7732.
   3. Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com
   4. Neokraft Signs, Incorporated, Lewiston, ME (800) 339-2258.
   5. Vomar Products, Incorporated, Van Nuys, CA (800) 521-2737.
   6. 2/90 Sign Systems, Grand Rapids, MI (800) 777-4310.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SIGNAGE

A. Pictographs:
   1. AIGA Symbol Signs reproducible art developed for the U.S. Department of Transportation is to be used whenever possible. Room signs shall have 1/32 inch raised one inch high Helvetica Medium (upper and lower case) lettering and Braille.
   2. Size: As indicated on drawings.
   3. Material: 1/8 inch minimum thick, integrally colored or clear acrylic plastic, or laminated acrylic. Conforming to ASTM D4802, non-glare (matte), UV stable, suitable for interior and exterior use.
   4. Color: Use colors below, unless designated by AIGA.
      a. Foreground (Characters and/or Graphics): White
      b. Background: Blue

B. Room, Directional, and Exit Signage
   1. Room signs shall have 1/32 inch raised one inch high Helvetica Medium (upper and lower case) lettering and Braille.
   2. Size: As indicated on drawings.
   3. Material: 1/8 inch minimum thick, integrally colored or clear acrylic plastic, or laminated acrylic. Conforming to ASTM D4802, non-glare (matte), UV stable, suitable for interior and exterior use.
   4. Color:
      a. Foreground (Characters and/or Graphics): White
      b. Background: Blue

C. Parking Signage:
   1. Sign: ASTM B209 aluminum sheet, 0.080 inch thick with rounded corners of at least 1/8 inch radius and eased edges. White figure on a blue background; non-glare, high contrast signs. The blue shall be equal to color number 15090 in Federal Standard 595B.
   2. Post: Existing as indicated on drawings, or 2 by 2 inch galvanized steel tubing, weighing minimum of 4.31 pounds per foot and conforming to ASTM A500, Grade B, 3/16 inch thick wall thickness.
   3. Concrete Post Footings: Refer to Section 32 1313, Site Concrete Work.
   4. Fasteners: Stainless steel carriage bolts with tamper resistant nuts or as indicated on drawings.
   5. Size: As indicated on drawings.
   6. Text: As indicated on drawings.

2.3 FASTENERS AND OTHER MATERIALS

A. Provide non-corrosive fasteners, hangers, and mounting devices which are compatible with sign material and finish.

B. Other materials, not specifically described, but required for a complete and proper installation of signs, shall be as selected and subject to approval of the General Services Director or Designee.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Examine foundations, walls, doors, ceilings and other areas scheduled to receive signs for conditions that would affect quality and execution of work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION

A. Install signage in accordance with manufacturer's published instructions.

B. Install sign units and components at the locations shown or scheduled, securely mount with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions.

C. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces.

D. Sign manufacturer to provide template for spacing of letters.

CONSTRUCTION

E. Interface with Other Work:
   1. Furnish full-size spacing templates for individually bundled letters and numbers for coordination with work of other trades.

3.3 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Inspect signage locations, attachments, and messages to verify installation conforms to Drawings.

END OF SECTION

SECTION 10 1500

BULLETIN BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass enclosed metal framed bulletin boards.
   2. Fabric wrapped bulletin boards.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Claridge Products and Equipment, Incorporated, Harrison, AR (870) 743-2200.
   2. Greensteel, Incorporated, Dixonville, PA (800) 766-4204.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 METAL FRAMED BULLETIN BOARDS

A. Manufacturer: Claridge.

B. Model 294 and 296 including the following:
   1. Sizes:
      a. 294: 36 inches high by 48 inches wide.
      b. 296: 36 inches high by 72 inches wide.
   2. Doors: Two 1/4 inch thick tempered glass, sliding, with integral cylinder lock device.
   3. Door Shoe, Channel and Track Material: Heavy gauge extruded aluminum.
   4. Door Shoe, Channel and Track Finish: Clear anodized brushed aluminum.
   5. Back Panel: No. 930, Hook Fab, with 7/32 inch cork underlay.
   6. Back Panel Color: #949 “Cloud”.

2.3 FABRIC WRAPPED BULLETIN BOARDS

A. Manufacturer: Claridge

B. B. Designer Series 3104EW
   1. Size: As indicated
   2. Color: Selected from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install bulletin boards in accordance with manufacturer's published instructions in locations indicated on Drawings.

B. Mount bulletin board plumb and level.

END OF SECTION

SECTION 104400

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes.
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
   3. Mounting brackets.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 10 - Portable Fire Extinguishers.

B. Underwriters Laboratories, Inc. (UL):
   1. UL 299 - Dry Chemical Fire Extinguishers.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data:
      a. Extinguisher type, operational features, color.
      b. Cabinet type, materials, construction, features, color, finish and attachment method.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to NFPA 10 and local jurisdiction for requirements for extinguisher location and mounting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products that may be incorporated in the work include the following:
   1. J.L. Industries, Bloomington, MN (800) 554-6077.
   2. Larsen's Manufacturing Company, Minneapolis, MN (800) 527-7367.
   3. Potter-Roemer, Incorporated, Cerritos, CA (800) 366-3473.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Extinguisher: Multipurpose dry chemical type, UL 299; UL-rated 4-A:60:B:C. 10 pound nominal capacity in enameled steel container.

B. Cabinet:
   1. Models:
      a. J.L. Industries: Clear VU Series No. 1515F25.
      b. Larsen's: Vista Series No. V-2709.
      c. Potter-Roemer: Buena Series No. 7121-A-16-VR.
   2. Description:
      a. Metal: Formed sheet steel.
      b. Mounting: Recessed.
      c. Trim: Trimless.
      d. Door: Clear acrylic bubble.
      e. Finish: Primer.
      f. Lettering: Vertical red 1-inch letters; "Fire Extinguisher."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify rough openings for cabinet are correctly sized and located.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City .

3.2 INSTALLATION

A. Install extinguisher and bracket or cabinet in accordance with manufacturer's published instructions in locations required by authority having jurisdiction.

B. Secure rigidly in place.

C. Locate extinguishers where indicated on Drawings.

END OF SECTION

SECTION 122000

WINDOW TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Horizontal metal slat louver blinds.
   2. Vertical blinds at Conference Rooms interior windows.
   3. Mounting system.
   4. Operating hardware.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Data indicating physical and dimensional characteristics and operating features.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Operation and Maintenance Data: Manufacturer's recommendations for maintenance and cleaning.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver to site in manufacturer's original packaging.

C. Store blinds to prevent damage to materials, finishes and operating mechanisms.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions: Take field measurements of openings to determine exact sizes required for each opening.

1.6 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Blinds
      a. Springs Window Fashions, LP, Montgomery, PA (800) 544-4749
      b. Hunter Douglas Inc., Upper Saddle River, NJ (800) 727-8953
      c. Levolor, Rockway, NJ (800) 826-8021

B. Section 016000 - Product Requirements: Product Options and Substitutions. Substitutions: Permitted.

2.2 HORIZONTAL BLINDS

A. Horizontal Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking open and closed point locking; blade angle adjustable by control wand.
   1. Springs Window Fashions, Bali: Classic 1 inch Mini Blinds, No. 042 "Matte White" color.
   2. Hunter Douglas: Contract Flexalum Decor 1 inch Aluminum Blinds Model CD80, No. 127 "Linen Flirt" color.
   3. Levolor: Monaco 1 inch Contract Blind, No. 115 "Dover" color.
      a. Headrail Attachment: Wall brackets.
      b. Accessory Hardware: Type recommended by blind manufacturer.

2.3 VERTICAL BLINDS

A. Vertical, 3 ½” PVC Louver Vanes hung from full width headrail, manual wand contol for traversing and rotating louvers.
   1. Springs Window Fashions: Graber G.85 Dura-Vue, #3353 “Alabaster”.
   2. Levelor: Horizon #8091 “Dover”.
   3. Hunter Douglas: Vertical Solutions, Color to match horizontal blinds.
      a. Headrail Attachment: Wall Brackets.

2.4 FABRICATION

A. Fabricate blinds to cover window frames completely.

B. At openings requiring multiple blind units, provide separate blind assemblies with space of 1 inch between assemblies, occurring at window mullion centers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify that structural blocking and supports are correctly placed.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's published instructions where indicated on Drawings.

B. Secure in place with concealed fasteners.

3.3 CONSTRUCTION

A. Interface with Other Work: Coordinate Work with window installation and placement of concealed blocking to support blinds.

B. Site Tolerances:
   1. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
   2. Maximum Offset From Level: 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Inspect installation, attachment, and operation of blinds.

3.5 ADJUSTING AND CLEANING

A. Section 017300 - Execution: Requirements for adjusting and cleaning.

B. Adjust blinds for smooth operation.

C. Clean blind surfaces prior to Final Acceptance inspection.

END OF SECTION

SECTION 12 3216

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabricated custom cabinets and fixtures.
   2. Countertops.
   3. Cabinet and fixture hardware.
   4. Preparation for installing utilities.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 01 1000 - Summary of Work: Requirements for Postal Service furnished Products.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat Formed Wood Particleboard.

B. Architectural Woodwork Institute (AWI):
   1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.

C. National Electric Manufacturer's Association (NEMA):
   1. NEMA LD3 - High Pressure Decorative Laminates.

D. United States Department of Commerce Product Standard (PS):
   1. PS 1 - Construction and Industrial Plywood.
   2. PS 20 - American Softwood Lumber Standard.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Data for hardware and accessories indicating material, type, function, attachment and finish.
   2. Shop Drawings:
      a. Indicate each material used, wood species, component profiles, sections, and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes in conformance with requirements of AWI AWQS.
      b. Indicate composition of each material and compliance with referenced standards.
      c. Keying Schedule: Indicate keying system for cabinet and fixture locks.
      d. Present drawings in related and dimensional positions; section details drawn at minimum 1-1/2 inch scale.
   3. Samples: Two 2 inch x 3 inch samples of each plastic laminate finish and color.
   4. Assurance/Control Submittals:

a. Certificate: Manufacturer certificate indicating that Products meet or exceed specified requirements.
b. Qualification Documentation: Custom cabinetwork and fixture manufacturer and installer documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI AWQS Custom quality.
1. Affix the AWI Quality Grade Stamp to each unit of custom cabinet and fixture work. The AWI Quality Grade Stamp shall display Custom Grade as specified for each section of Work.

B. Qualifications:
1. Manufacturer: Company specializing in manufacturing store fixtures specified in this section with minimum five years documented experience. Member in good standing of the Architectural Woodwork Institute.
2. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Package fixtures in watertight container for transportation to project site to prevent damage and for storage outside building, if required.

C. Protect fixtures from damage and excessive or inadequate relative humidity.

D. Maintain relative humidity between 25 percent and 55 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Local millwork manufacturers may be approved by General Services Director or Designee.
2. Submit documentation indicating local millwork manufacturer has produced millwork of a quality acceptable to City of Torrance for Projects of similar type to Work of this Contract.
3. Obtain approval from General Services Director or Designee.

2.2 WOOD MATERIALS

A. Softwood Lumber: PS 20; graded in accordance with AWI Custom; average moisture content of 6 percent.

B. Hardwood Lumber: NHLA; graded in accordance with AWI Custom; average moisture content of 6 percent.

2.3 PANEL MATERIALS

A. Softwood Plywood: PS 1; graded in accordance with AWI, core materials of particleboard.

B. Hardwood Plywood: PS 51; graded in accordance with AWI, core materials of particleboard, type of glue recommended for application.

C. Wood Particleboard: PS1; AWI standard, composed of wood chips, medium density, made with water resistant adhesive; of grade to suit application; sanded faces.

D. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, tempered grade, smooth two sides

2.4 PLASTIC LAMINATE AND OTHER FINISH MATERIALS

A. Manufacturers: Subject to compliance with project requirements provide plastic laminates and other finish materials of one of the following:
1. Formica Corporation.
2. Micarta Corporation.
3. Nevamar Corporation.
4. Wilsonart International.
5. Pionite.
6. Samsung.
7. Forbo

B. High-Pressure Decorative Laminate: NEMA LD3, GP-50 General Purpose .050 inch.

C. Low Pressure Laminate: Melamine thermo set decorative overlay.

2.5 COLOR SCHEDULE – See Drawings

2.6 ACCESSORIES

A. Adhesive: Type recommended by AWI to suit application.

B. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Metal material for cut-outs.

2.7 HARDWARE

A. Necessary to perform the work.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.8 FABRICATION

A. Fabricate cabinets and fixtures to AWI AWQS, Section 400 - Architectural Cabinets, Custom Grade Standards.

B. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

C. Fit shelves, doors, and exposed edges with matching plastic edging. Use one piece for full length only.

D. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Door and Drawer Fronts: Plastic laminate

F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

G. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.

H. Install solid surface countertop. Color per Drawings

I. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

J. Provide cutouts for inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify custom cabinet and fixture dimensions by field dimensions.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

A. Install custom fabricated cabinets and fixtures in conformance with AWI AWQS, Section 1700 - Installation of Woodwork.

B. Set and secure fixtures in place; rigid, plumb, and level at locations indicated on Drawings.
   1. Attach to floor or walls with fasteners as indicated on Drawings.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Carefully scribe fixtures abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure fixtures to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 CONSTRUCTION

A. Interface with Other Work:
   1. Coordinate installation sequence of fixtures with trades providing data and communication connections to fixtures.

B. Site Tolerances:
   1. Maximum Variation from True Position: 1/16 inch.
   2. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Inspection procedures.

B. General Services Director or Designee will inspect custom cabinet and fixture installation, alignment, attachment to structure, and connection to data and communication lines.

3.5 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING AND PROTECTION

A. Section 01 7300 - Execution Cleaning and protection of installed Work.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 21 1313

FIRE-SUPPRESSION SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire sprinkler system for protection of buildings.
2. Standpipe system.

B. Related Requirements: The requirements of this Section, NFPA 13 and NFPA 14 shall take precedence over requirements found in the following:

1. Division 01 - General Requirements.
2. Section 07 8413: Penetration Fireproofing.
3. Section 09 9000: Paints and Coatings.
4. Section 10 4400: Fire Protection Specialties.
5. Section 22 0500: Common Work Results for Plumbing.
6. Section 22 0513: Basic Plumbing Materials and Methods.
7. Section 22 0553: Plumbing Identification.
8. Section 22 1000: Plumbing.
9. Section 26 0500: Common Work Results for Electrical.
10. Section 28 3100: Fire Detection and Alarm.
11. Section 31 2323: Excavation and Fill for Utilities.
12. Section 33 1100: Site Water Distribution Utilities.

1.02 SUBMITTALS

A. Manufacturer’s Data:

1. Submit complete and detailed equipment and material list of items to be furnished and installed under this section.
2. Submit manufacturer's specifications and other data required to demonstrate compliance the plans and specified requirements.

B. Drawings:

1. Submit shop drawings of wet pipe fire protection sprinkler system in compliance to NFPA 13, Standard for the Installation of Sprinkler Systems, Sprinkler systems shall comply with the provisions of NFPA 13.

2. Shop drawings shall fully comply with the most stringent provisions of this specification and plans, and with the applicable codes and standards.

3. Shop drawings shall be same size as the Contract Drawings and shall be produced using AutoCAD.

C. Regulatory Requirements:

1. Installation of fire sprinkler system shall not vary from the plans unless alterations have been approved by the City Fire Department.

2. Complete Fire Department standard testing forms and get sign-off by the Project Inspector.

D. Closeout Submittals: Submit in accordance to Section 01 7700, Contract Closeout, and as specified herein:

1. Record Drawings:

a. Record drawings of installed Work shall be maintained current on the Project site, available for Fire Marshal and the Project Inspector to review.

b. At completion of installation submit Record Drawings signed by installing Contractor in AutoCad format, including:

1). Record Specifications.

2). Record Product Data: Include specific model, type and size for equipment and material installed.

3). Record Test Results.

4). Maintenance Manuals.

1.03 QUALITY ASSURANCE

A. Comply with applicable national or local codes and standards.

B. Except where exceeded by the requirements of these specifications, the following are made part of this section: prints and details, and provisions of the NFPA 13 Standard for Installation of Sprinkler Systems.

C. Qualifications of Manufacturer: Products used in work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a 5 year history of successful production that is acceptable to the Architect.

D. Qualifications of Installer: Installer shall have a current C-16 license in the State of California in the installation of fire sprinkler systems.

1.04 FIRE SERVICE WATER CONNECTION

A. The Owner shall pay fees and provide for the fire main POC (point of connection), consisting of the installation of a single detector check valve (if one is required) and meter shut off valve inside a meter vault.

B. Fire Service Mains shall be provided with approved Meter Service Backflow protection. An approved Reduced Pressure Principle Backflow Prevention Assembly (RP) to meet minimum backflow protection requirements for meter service protection (MSP) shall be provided on the fire main, according to the California Plumbing Code (CPC) and according to the current Los Angeles Department of Water and Power WATER SERVICE RULE 16-D where applicable (see section 2.02.D for backflow assemblies). Double Check Assemblies shall only be used with the written approval of the Water Purveyor.

1.05 PRODUCT HANDLING

A. Comply with the provisions specified in Sections 22 0500 and 22 0513.

1.06 COORDINATION

A. Coordinate activities in accordance with provisions of Section 22 0500.

1.07 JOB CONDITIONS

A. Unscheduled utility flow interruptions are not permitted. Schedule service interruptions in advance, with the OAR.

1.08 EXTRA MATERIALS FOR MAINTENANCE

A. Provide spare sprinkler heads in quantity equal to 2 percent of total number of each type of sprinkler head installed. There shall be no less than two heads of each type and temperature rating provided, and in no case less than six spare sprinkler heads per building. There shall be no fewer than 6 spare sprinkler heads for up to 300 sprinkler heads installed; no less than 12 spare sprinkler heads for up to 1,000 sprinkler heads installed; and no less than 24 spare sprinkler heads for the sites with more than 1,000 sprinkler heads installed. Spare sprinkler heads shall be kept inside of spare sprinkler head box(s). A spare sprinkler wrench for each type of sprinkler head shall also be provided inside of each spare sprinkler head box, at each building. Locations of spare sprinkler boxes shall be located at:

1. To City, when Fire Sprinkler Riser is exposed.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SYSTEM DESCRIPTION

A. General: Provide systems complete including, but not limited to:

1. Provide underground and above ground sprinkler piping including trenching and backfilling. Materials and equipment shall be UL/FM listed and approved as required by NFPA for their application. Required signage shall be provided and installed as required by NFPA 13 and NFPA 14.

2. Provide overhead sprinkler system with sprinklers installed as required according to type, location and temperature rating.

B. Sprinkler Heads:

1. Provide chrome pendant spray type sprinkler heads with matching escutcheons in areas with finished ceilings. Exterior escutcheons shall be poly-coated or concealed type to prevent rusting and oxidation.

2. Provide upright sprinklers in areas with exposed piping.

3. Provide poly-coated glass bulb corrosion resistance type sprinklers heads in areas exposed to a corrosive environment such as parking garages and coastal air.

4. Sprinklers shall be glass bulb type, with hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation,

5. Sprinklers in concealed spaces, exterior locations, and other areas that will experience over 100 degrees F ambient temperature shall be furnished with 200 to 225 degree rated sprinklers. Sprinkler heads in boiler rooms, furnace rooms, or heater rooms shall be furnished with sprinklers rated at 250 to 290 degrees F. If a sprinkler is directly affected by a spotlight, steam, or other heat source, a 350 degree F or higher sprinkler head shall be furnished. Sprinkler heads in other locations, unless otherwise noted, shall be 155 to 165 degrees F rated.

6. Automatic fire sprinkler head type shall be as follows:

a. In areas with ceiling heights of nine-feet or lower, sprinkler heads installed shall be recessed or fully concealed.

b. Ceilings eight-feet or lower shall be provided with fully concealed sprinkler heads.

c. Areas with ceiling height of nine-feet or lower, that are not constantly supervised such as corridors, arcades, students restrooms, and other restrooms shall be provided with fully concealed sprinkler heads.

7. Sprinkler heads in light hazard occupancies are required to be Quick Response sprinklers as required in NFPA 13. Sprinkler heads shall be of the same manufacturer throughout the building/site as indicated. Sprinklers shall typically be ½ inches NPT, standard orifice, minimum 5.6 nominal K factor, UL listed for 175 psi, and listed for light and ordinary hazard occupancies.

8. Other specialized sprinkler heads such as walk-in refrigerator or freezer heads, side wall, ¾ inches sprinklers above 5.6 K factor, and those sprinklers with a K factor below 5.6, shall only be used where required by project condition. Large drop sprinkler heads and extended coverage sprinkler heads shall not be installed.

9. Sprinkler head location shall be designed and installed in an aesthetically pleasing manner and should generally be located in center of 24-inch by 24-inch ceiling tiles and in center of 24-inch by 48-inch ceiling tiles in the 24-inch direction and no closer than 12-inch from the edge in the 48-inch direction.

10. UL/FM listed Sprinkler head guards shall be provided on Sprinkler heads installed at seven feet six inches above floor or lower in exposed locations, or that are deemed subject to damage. Sprinkler head guards shall securely fasten with bolt-on feature to the base of the sprinkler or be a factory installed guard. Guards shall also be provided on upright and sidewall heads where sprinklers are installed at seven feet six-inch heights or lower.

C. Fire Sprinkler Systems:

1. Underground piping: Comply with the requirements of Section 33 1100, Site Water Distribution Utilities.

2. Provide an underground UL/FM listed PVC or Ductile iron supply line connected to detector check meter or water main as indicated. Install site water mains no closer than 10'- 0" parallel to the building foundations. Underground fire water lines shall be installed 36 inches below grade. Tracer wire shall be installed in accordance with Section 33 1100: Site Water Distribution Utilities.

3. Fire Department Connection (FDC) with check valve (wafer type) shall be provided after the backflow preventor, and before the building fire sprinkler riser(s), located where the FDC will be accessible to the fire department from the street or sidewalk without obstructions. No shut off valve shall be allowed on the FDC line as per NFPA 13. FDCs shall have a height between two and four-foot above the ground.

4. PIVs shall be electrically supervised regardless the number of fire sprinkler served (CBC 903.4), and set at a height of three feet to the top and have the handle locked in place with a break-a-way lock.

5. Provide a UL listed, FM approved FDC, approved RP type backflow assembly, check valves, shut-off valves, drain valves, ITV, and flow indicator at the locations required. (Test-and-drain combination valves are prohibited.)

6. Flow indicator shall activate the fire alarm system between 45 and 90 seconds, and activate a local alarm on the outside of the building continuously with water flow. Connection of this switch is a part of the Work of Division 26. Shut-off including valves on the fire main backflow preventor shall be electrically supervised according to CBC 903.4,, NFPA 13 and Section 28 3100 – "Fire Detection and Alarm".

7. Pipe through ceilings at head locations shall be furnished with a two piece, or fully concealed escutcheon. Unless otherwise designated, escutcheons shall be identical and match the other escutcheons of the same type throughout the building or site. Piping through walls and ceilings shall have a split ring chrome escutcheon.

   a. Flexible stainless steel sprinkler head drop system may be used. Flexible drops shall be UL listed, FM approved, and shall be compatible with ceiling systems. Flexible drop length shall be included in the Hydraulic Calculations. The drop system shall include the required support bracing.

8. Furnish and install required signs, spare heads, special wrenches, and spare sprinkler head boxes as required to satisfy NFPA 13, and this specification.

9. Sprinkler system piping shall be provided with complete drainage as required by NFPA. Test valve discharge shall be piped away from planters to asphalt areas. Furnish protection of piping against accidental or malicious damage.

10. Upon completion of the Work of this section, and before Substantial Completion, subject system, including underground supply connection, to tests required. A minimum hydrostatic test shall be two hundred pounds (200 psi) or fifty pounds (50 psi) in excess of the maximum system working pressure, whichever is greater, for two hours with no leaks or loss of pressure per NFPA 13. The Project Inspector shall be furnished with a NFPA 13 test certification.

11. Local fire sprinkler alarm requirements shall be accomplished with a vane or paddle type water flow detector switch and an electrically powered fire sprinkler horn located on the street side of the building and connected to the fire alarm control panel with secondary power provided from the fire alarm batteries. The drilled out disk shall be attached to the mounting U-bolt. Time delay shall be set at 45 to 60 seconds. Mechanically activated water bells with alarm valve and pressure switch are prohibited.

12. Seismic separation assemblies shall be located between the buildings if space allows accessibility. Otherwise they shall be located inside the building providing the most space. Swing joints may be fabricated on site using flexible groove couplings and six grooved (Victaulic) 90 degree elbows in a teepee formation (see NFPA 13, figure A.9.3.3). Seismic separation assemblies can also be made utilizing a manufactured, UL/FM listed swing joint assembly rated at a minimum 175 psi.

13. Hanging, bracing and support shall utilize only UL/FM listed approved products, and comply with NFPA 13, Chapter 9 requirements for rod and bolt sizes except for the following: 4 and 6 inch pipe shall be supported by a minimum ½ inch hanger rod, 8 inch pipe shall be supported by a minimum 5/8 inch hanger rod, 10 and 12 inch pipe shall be supported by a minimum ¾ inch hanger rod. Hanger rods in exterior locations and in parking structures shall have Electrodeposited Zinc Coating per ASTM B633 to prevent rusting.

14. Building Fire Sprinkler riser assemblies shall be provided as follows. Every building shall be provided with an accessible and electrically supervised riser shut off valve at a height not to exceed five-feet above the floor. Every building riser assembly shall be equipped with a check valve followed by a main drain valve and then the flow indicating switch and pressure gauge immediately after the shut-off valve. In cases where a riser assembly is provided for each floor in the building, a check valve, main drain and flow switch shall be provided for each floor; the main building shut-off shall not be required. An electrically supervised Post Indicator Valve located outside the building may serve as the building riser shut-off valve.

2.02 MATERIALS

A. Access Panel:

FAP-1 Square, steel, prime-coated, with vandal-proof door lock operated by Allen wrench:
Smith Josam Elmdor Or equal

4760		DW – AKL

B. Globe or Angle Valves: UL/FM listed.

AV-1 Bronze angle valve: 2 inches and smaller, screwed-in bonnet, threaded ends, rising stem:

Nibco	Kennedy	Fairbanks	United	Or equal
T-301	98 SD	0210	126T	

C. Automatic Fire Sprinkler Head, UL/FM listed:

AFSH-1 Brass pendant type for areas with suspended ceilings:

Victaulic	Tyco	Viking	Reliable	Or equal
V27	TY 3231	VK302	F1FR56	

AFSH-2 Brass upright type for areas with no ceilings:

Victaulic	Tyco	Viking	Reliable	Or equal
V27	TY3131	VK300	F1FR300	

AFSH-3 Chrome or poly coated semi recessed type with semi-recessed escutcheon:

Victaulic	Tyco	Viking	Reliable	Or equal
V27	TY3231	VK302	F1FR56	

AFSH-4 Fully concealed type sprinklers; chrome cover:

Victaulic	Tyco	Viking	Reliable	Or equal
V38	TY3531	VK462	F4FR	
		VK404	G4A	

D. Backflow Prevention Assemblies:

BPV-1 Reduced Pressure Principle Backflow Prevention Assembly (RP) type for meter service protection (MSP) requirements:

Ames	Febco	Watts	Wilkins	Or equal
4000SS	860 OS&Y	909 RP	975 RP	
C400	880 OS&Y	957 RP	375 RP	
M400		994 RP		

BPV-2 Reduced Pressure Principle Detector Assembly (RPDA) for MSP requirements:

Ames	Febco	Watts	Wilkins	Or equal
5000SS	860 DA	909 RPDA	950 DA	
C500	880 DA	957 RPDA	350 DA	
M500		994 RPDA		

E. Gear Operated Butterfly Valves:

GOBFV-1 Grooved end Gear Operated Butterfly Valve, 300 psi, for fire protection sprinkler risers. UL listed, FM approved, with weatherproof gearbox and double pole/double throw monitor switch, double seal design for bubble tight shut off at 175 psi. Corrosion-resistant, fusion-bonded nylon II body coating, easy to read position indicator:

Kennedy Figure 82M	Nibco GD-4765-8N, 300 psi	Victaulic 705W 300 psi	Tyco 580 300 psi	Or equal

GOBFV-2 Wafer Type Gear Operated. Butterfly Valve, same requirements as GOBFV-1:

Kennedy Figure 82W	Nibco WD-3510 300 psi	Or Equal

F. Check Valves:

CV-1 Bronze check valves: 2 inches and smaller, 200 psi WOG, bronze disc, swing type, conforming to MSS-SP-80-97, threaded ends:

Crane 37	Nibco T-433-Y	Stockham B-319	United 62T	Or Equal

CV-2 Iron check valves: 2-1/2 inches and larger, class 175, composition disc, swing type, bolted cap, UL listed, FM approved flanged ends:

Stockham G-940	Kennedy 126	Tyco Model G	Clow F5380	Or Equal

CV-3 Wafer Type Check Valve:

United Wafer Check #90 Or equal.	Nibco KW-900-W	Mueller A-2102

CV-4 Grooved Check valve 2 ½ inch and larger:

United 67 Or equal.	Gruvlock 7800	Reliable Mode “G”	Victaulic Series 717	Tyco 590F

G. Escutcheons

ES-1 Chrome plated, or white poly-coated, 2-piece canopy (escutcheon), 2.25 to 3.5 inches in extended position:

FPPI 01 - 401 Chrome or White	Tyco No. 401 Chrome or White	Reliable HBC (chrome) HBW (white)	Or equal

ES-2 Chrome plated or white poly coated, 2-piece recessed:

FPPI	Tyco	Reliable (semi recessed)	Or equal

01 - 400	410	GF2-C (chrome)
01 - 402	420	GF2-W (white)

H. Fire Department Connections:

FDC-1 UL listed, FM approved, type, 4 inch by 2-1/2 inches by 2-1/2 inches bronze body fire department hose connection (FDC):

Crocker 6405 or 6420	Potter-Roemer 5710 or 5730	Tyco 86	Powhaten 21-201 or 31-133	Or equal

I. Flow Indicators:

FIA-1 Listed by State Fire Marshal, with double pole, double-throw switch, one normally open and one normally closed, UL listed and FM approved:

Potter-Roemer VSRF Series	Notifier WFR Series	Or equal

J. Outside Stem and Yoke Gate Valves:

OS&Y-1 Bronze Gate Valves: 2 inches and smaller, class 175, solid bronze wedge disc, OS&Y, copper silicon alloy stem, UL/FM listed, threaded ends:

Stockham B-133	Crane 459	Nibco T-14	United 18	Or equal

OS&Y-2 Iron gate valves: 2 ½-inch and larger, class 175, IBBM, OS&Y, solid wedge disc, Teflon-impregnated packing, UL/FM listed, flanged ends:

Stockham G-634 Or equal.	Crane 467	Kennedy 68	Mueller A-2073	Victaulic 771

OS&Y-3 2 ½-inch and larger, epoxy coated, resilient wedge, 175 pounds gate valve for riser valves, P.I.V., and shut off:

Clow F-6136	Nibco 617-0	Kennedy KV-4068	Mueller A-2360	Or equal

K. Gate Valves:

GV-1 Bronze gate valves: 2-inch and smaller, class 175, solid bronze wedge disc, rising stem copper silicon alloy stem, UL/FM listed, threaded ends:

Stockham B-133	Crane 459 Fig. 66	Grinnell	United 14	Or equal

GV-2 Iron gate valves: 2 ½-inch and larger, class 175, IBBM, solid wedge disc, Teflon impregnated packing, UL/FM listed, flanged ends:

Stockham	Crane	Kennedy	Mueller	Victaulic

G-634 467 68 A-2052 772
Or equal.

L Gear Operated Ball Valves:

GOBV-1 Threaded ball valve for sizes two inches and smaller:

Nibco KT-505W-4 Victaulic 728 Or equal.

M. Seismic Swing Joints:

SJ-1 UL/FM Approved flexible seismic connector with grooved, or threaded ends for seismic separation requirements.

SJ-2 Fabricated swing joints as per NFPA 13 using six groove 90 degree elbows and flexible groove couplers such as Victaulic style 75.

N. Post Indicator Valves:

PIV-1 Vertical Indicator Posts: Furnished for underground valves, post must provide a means of knowing if the valve is open or shut, UL/FM listed. (Where a backflow assembly is provided, the shutoff valves on the backflow preventer satisfy the requirement for a post indicator valve to control the fire main and FD Connection):

Stockham	Kennedy	Grinnell	Or equal
G-951	2945	F-750	
Clow	Mueller	Victaulic	
F-576	2945	774	

PIV-2 Posts Indicator valve: Furnished for underground valves. Ductile iron fusion bonded epoxy coated resilient wedge gate valves: 4 inches and larger, class 175 lb, non-rising stem, mounting plate for indicator post, UL/FM listed, flanged or mechanical ends (in accordance with NSF 61).

Stockham	Kennedy	Clow	Mueller	Victaulic
G-635	71X	F-6100	2360	772
O equal				

O. Sprinkler Guards:

SPG-1 Sprinklers installed at seven feet six inches above floor or lower in exposed locations, or that are deemed subject to damage shall be equipped with a UL/FM listed, head guard. Guards shall be listed, supplied and approved for use with the sprinkler by the sprinkler manufacturer. Sprinkler head guards shall securely fasten with bolt-on feature to the base of the sprinkler or be a factory installed guard. Guards shall also be provided on upright and sidewall heads where sprinklers are installed at seven feet six-inch heights or lower.

Reliable Viking Tyco FPPI Victaulic

Or equal.

P. Sprinkler Horn:

SPH-1 UL/FM approved, surface-mounted, weatherproof and red finished:

Horn:	Bell:	Wheelock equal
HRK System Sensor	SSM-24-10 System Sensor	
24 V-DC	24 V-DC	
Weatherproof with	Weatherproof with	
BBS-2 back-box for	WBB box for	
Surface mount	Surface mount installation	

Or equal

Q. Hangers, Supports, Bracing:

HSB-1 Tolco products or UL listed and FM or equal.

R. Threaded fittings:

TF-1 Ductile iron, 300 psi rated, UL listed, FM or NFPA approved.

TF-2 Cast iron fittings, 175 psi rated, UL listed, FM or NFPA approved:

Anvil Ward Taylor Or equal

TF-3 Malleable Iron, 300 psi rated, UL, Listed, FM or NFPA approved

TF-4 Galvanized, 175 psi rated, UL Listed, FM or NFPA approved

S. Fire Sprinkler Pipes:

FSP-1 Fire sprinkler pipe: 1 inch through 8-inch, Schedule 40, black or galvanized steel meeting ASTM Standards A53, A135, or A795. Pipe Corrosion Resistance Ratio (CRR) shall be 1.00 or greater. Pipe may be threaded or grooved.

a. Piping 2 inches and smaller shall have threaded joints and fittings in concealed, non-accessible locations. Groove coupler connections (Victaulic, Viking VGS, or equal) on pipe sizes 1 inch through 2 inches are acceptable in accessible areas with required seismic bracing provided. Plain end connections such as “Plainlock” and “FIT” are prohibited.

b. For pipe sizes 2 ½-inch and larger, grooved type (Victaulic, Viking VGS, or equal), welded, threaded and flanged connections may be used. Any connection that does not utilize a threaded, welded or grooved connection is prohibited, except for mechanical tee bolt-on

branch outlet fittings sizes 2-inch and smaller (Victaulic 920 and the 920N).

c. Submit Verification from manufacturer stating that piping material furnished meets above criteria; (i.e.: threadable pipe has a UL assigned CRR of 1.00 minimum, that it meets ASTM A53, A135 or A795, and it is UL listed, FM or NFPA approved.)

FSP-2 Ductile iron pipe, AWWA C151 (for pipes below grade). Gasketed self retaining joints per ASME/ANSI B16.4.

FSP-3 Plastic, PVC, thick wall (cast iron OD sized), DR 14 (200 PSI). UL listed for fire main service (underground). Gasketed self retaining joints - Johns Manville Blue Brute AWWA C900, JM Eagle C900 water pipe or equal.

FSP-4 Fire Sprinkler Pipe: 1 inch through 3-inch, Copper meeting NFPA 13 Standards. Pipe may be grooved.

FSP-5 Flexible Fire Sprinkler Head Connectors: 1 inch pipe size flexible stainless steel fire sprinkler head connectors “Flex Head Industries” Models 2024, 2036, 2048, 2060 and 2072, or equal..

2.03 ACCESSORIES AND APPURTENANCES

A. Escutcheons: Polished chrome plated split-ring type for exposed piping at every penetration inside finished rooms.

B. Guards: Provide sprinklers with guards at ceiling at or under seven feet six-inch high and where subject to damage or vandalism.

C. Miscellaneous: Provide accessories and appurtenances for a complete system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe ends.

B. Remove scale and foreign matter, from inside and outside of pipes, before assembly.

C. Provide piping connections to equipment with flanged or grooved connections.

3.03 INSTALLATION

A. Install underground supply line connected to detector check or water main indicated. Braced or clamped bends shall be in accordance with requirements of NFPA 24. Provide vertical clamp rods at flange and spigot piece of risers, long enough to pass through riser's base flange where required. Furnish concrete thrust blocks where required. Tracer wire shall be installed as per Section 22 0553: Plumbing Identification on PVC underground piping.

B. Install FDCs, check valves, shut-off valves, gauges, Inspector's test and drain assemblies and flow indicator. FDC must be installed so that it is unobstructed and accessible for the Fire Department's first response unit.

C. Pipe through floors, wall, and ceilings, at head locations, shall be furnished with required sleeves, and escutcheons and fire caulking where indicated and/or required by code. Escutcheons shall be polished chrome plated unless other finish is selected by the Architect.

D. Sprinkler system shall be provided with complete drainage facilities in accordance with CBC standards. Drain discharge may discharge into a sewer, storm drain, sump pit or street gutter. Fire sprinkler drains shall not discharge onto a playground or across a sidewalk. Discharge to plumbing fixtures is prohibited due to the inability of a plumbing fixture to receive a full flow of water from a fire sprinkler drain valve under working pressure.

E. Upon completion of the Work of this section, and before Substantial Completion, subject the entire system, including underground supply connections, to tests as required by NFPA 13, and CBC standards and furnish the Owner with a certificate of compliance as required.

F. Close nipples are prohibited. Threaded unions are prohibited. Where a threaded union or coupling is needed, a groove type fitting (Victaulic or equal) shall be used instead. If a groove style coupling is used in a concealed area, an access panel allowing full access to that connection shall be provided.

G. Fire sprinkler systems piping hangers, seismic bracing, anchors and supports shall conform to NFPA 13, CBC and other applicable codes and the requirements of this specification.

H. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.

I. Tee branch outlets on fire sprinkler mains shall be by the use of a threaded ductile iron tee fitting, a groove type tee fitting, (Victaulic or equal), or by the use of a thread-a-let welded on by a certified welder as required by NFPA. Mechanical tee bolted branch outlet fittings are prohibited except for branch outlet sizes 2-inch and smaller.

J. Sprinkler lines within the building shall be concealed within the structure. Risers shall be installed in utility, supply rooms or similar service areas whenever possible, and shall not obstruct access, or maintenance of other equipment within the space. Mains and risers shall be located within the area protected by the sprinkler system unless otherwise approved by fire authorities having jurisdiction.

K. Sprinklers that have been dropped, damaged, have cracked bulbs, or show a visible loss of fluid shall not be installed.

L. Sprinkler bulb protectors shall be removed by hand after sprinkler installation. Tools or other devices to remove the protector that could damage the bulb in any way shall not be used.

M. Routing of piping in non-concealed exposed areas shall be subject to the Architect's review in the final shop drawings.

N. Underground piping shall have a minimum of 36 inches of cover to grade. Underground pipe shall be installed on a flat not less than 6-inch thick undisturbed sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick, before backfilling. Comply with NFPA Standards. Piping is not allowed to be underground below the building floor slab.

O. Provide approved backflow prevention assemblies. Installations of backflow prevention assemblies shall be tested and certified by a certified Los Angeles County backflow prevention device tester prior to Substantial Completion. Tests shall be performed in the presence of the Project Inspector. Test reports shall be turned over to the Project Inspector for mailing to proper agency.

P. Provide shunt trip when sprinklers are installed in the elevator machine rooms and elevator hoist way unless the sprinklers are located 2 feet or less from the hoist way pit floor.

Q. Test valve (ITV) shall be located at the opposite end of the sprinkler system from the supply. Test-and-drain type combination valves are prohibited. ITV discharge and main drain lines shall be piped to a sump pit or to the outside of the building to within a foot from the ground where it will drain away from the building to an exterior storm drain.

R. Each building with a sprinkler riser shall be furnished with an accessible shut off riser valve installed no higher than five feet from the finish floor. Each floor shall have a separate shut off valve with flow switch, and shall be securely enclosed or secured with a chain and break-a-way lock. Also see section 2.01- C-12 of this specification.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose at off-project site.

END OF SECTION

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section provides the basic plumbing requirements that apply to the Work of Division 22.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Division 22: Plumbing
   3. Division 23: HVAC
   4. Division 26: Electrical.

1.2 REGULATORY REQUIREMENTS

A. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.
   1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.
   2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.
   a. Test samples for lead content by the atomic absorption spectrophotometry method.
   3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.
   4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.

B. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:
   1. ANSI - American National Standards Institute.
   2. ASME - American Society of Mechanical Engineers.
      a. ASME Boiler and Pressure Vessel Code.
      b. ASME B31 - Standards for Pressure Piping.
   3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
   4. ASTM - American Society for Testing and Materials.
      a. ASTM A53 Specification for Welded and Seamless Pipe.
   5. AWWA - American Water Works Association.
   6. CSA - Canadian Standards Association.
   7. FM Global - Factory Mutual Global
   8. IAPMO - International Association of Plumbing and Mechanical Officials.

9. NFPA - National Fire Protection Association.
10. OSHA - Occupational Safety and Health Administration.
11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
12. UL - Underwriters Laboratories Inc.
13. Intertek (ETL Certification).

C. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:
   1. CBC, California Building Code, and CMC, California Plumbing Code.
      a. Latest edition as adopted by the City of Los Angeles, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.
   3. OSHA - Occupational Safety and Health Administration.
   4. CDPH - California Department of Public Health.
   5. SCAQMD - South Coast Air Quality Management District.

D. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

E. Permits and Fees: Refer to the General and Supplementary Conditions.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 22 sections, as applicable.

B. The above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 3113: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 3113 and Section 01 3300 and shall indicate at a minimum:
   1. Complete system layout of equipment, components, plumbing fixtures, piping, indicating service clearances, and pipe sizes, fitting types and sizes and pipe elevations, distances of pipes and equipment from building reference points and hanger support locations. The above items shall be coordinated on the shop drawings according to the requirements of Section 01 3113.
   2. Schedule and description of equipment, piping and fittings.

1.4 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:
   1. Provide a complete set of plumbing in AutoCAD. Also submit one set of full size reproducible plots on vellum and 3 sets of prints.
   2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit two copies of operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return three copies of manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.
2. Contents of Manual:
    a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.
    b. Manufacturer's operating instructions including, but not limited to, the following:
        1) Identification of components and controls.
        2) Trouble shooting checklist and guidelines.
        3) Recommendations for optimum performance.
        4) Warnings and safety precautions on improper or hazardous operational procedures or conditions
    c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 22 that includes the following as a minimum:
        1) Manufacturer’s model, identification and serial numbers.
        2) Exploded view of assembly drawings identifying each component or part with the relevant part number.
        3) Directory of manufacturer’s representatives, service contractors and part distributors.
        4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.
    d. Project Record Drawings: Complete set of plumbing, in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.
    e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 23 0593.
    f. Los Angeles County industrial waste permits.
    g. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.
    h. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.5 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.7 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.8 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:
   1. A minimum of 4 hours of on-site overview of the overall Plumbing System.
   2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, troubleshooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.9 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.1 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.2 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes pass through or are located within one inch of any construction element, install a resilient pad, ½ inch thick minimum, to prevent contact.

C. Furnish provisions for recesses, chases, and accesses and provide blocking and backing for proper reception and installation of plumbing Work.

3.3 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment indicated on the Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.4 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 22, including this Section.

B. Additional tests may be required in the case of products, materials, and equipment if:
   1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.
   2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

C. Piping Tests:
   1. Perform tests required to demonstrate that operation of plumbing systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.
   2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.
   3. Pressure gauges furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.
   4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where

local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Inspector.
6. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

D. Pipe Testing Schedule:

System Tested	Test Pressure (psig)	Test With:
Vent and roof drain (except pipes running under a slab or underground)	Fill with water to top of highest vent; allow to stand two hours, or longer, as required by Inspector. Minimum head required for any joint shall be 10 feet in building.	Water
Cast-iron soil, waste and interior downspout, condensate drain from air conditioning equipment	10 feet of water, vertically	
Domestic water piping	200	Water

E. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.
2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.
3. Run test the equipment after start-up for five consecutive days. Tests shall include operation of all equipment and systems for a period of not less than two 8-hour periods at 90 percent of the full specified capacities.
4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.
6. Provide electric energy and fuel required for tests.
7. Final adjustment to equipment or systems shall meet specified performance requirements.
8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

F. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.
2. Prior to final test and balance, plumbing equipment and systems shall be operated and tested as indicated in Article 3.04.F above to demonstrate satisfactory overall operation of the installed systems.
3. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 22 0513: Basic Plumbing Materials and Methods.

3.5 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by plumbing systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.6 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 5000: Construction Facilities and Temporary Controls, the following shall be provided:
   1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.
   2. Protect installed Work.
   3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.
   4. Protect covering for bearings, open connections to tanks, pumps, compressors and similar equipment.
   5. Interior of piping shall be maintained free of dirt, grit, dust, and other foreign materials.
   6. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.
   7. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas.

END OF SECTION

SECTION 220513

BASIC PLUMBING MATERIALS AND METHODS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Division 22: Plumbing.
   3. Division 23: HVAC.
   4. Division 26: Electrical.

1.2 SUBMITTALS

A. Provide in accordance with Division 01, Section 22 0500 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.3 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

D. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the ARCHITECT.

1.4 COORDINATION

A. Coordinate related Work in accordance with provisions of Section 01 3113: Project Coordination.

PART 2 – PRODUCTS

2.1 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in Section 22 0500, manufacturer's instructions or as required.
   1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.2 MANUFACTURERS AND MATERIALS

A. Ball Valves: 2-inch and smaller:
BV-1: Class 150, 600 psi, Bronze, CWP two-piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.
Manufacturer: NIBCO T-685-66-LF/S-685-66-LF, Hammond UP8303A/UP8513, Milwaukee UPBA400S/ UPBA450S, or equal.

B. Gate Valves:
   1. Bronze, 2-inch and smaller:
      GV-1: Class 125, 200 psi, CWP, bronze body and bonnet, non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:
      Manufacturer: NIBCO T-113-LF, Milwaukee UP105-P2, Hammond UP645, or equal.
      GV-2: Same as GV-1, except solder ends:
      Manufacturer: NIBCO S-113-LF, Milwaukee UP115, Hammond UP647, or equal.

C. Globe Valves:
   1. Bronze, 2-inch and smaller:
      GLV-1: Class 125, 200 psi, CWP, screw-in bonnet, Teflon disc, threaded ends:
      Manufacturer: Milwaukee UP502-P2, Hammond UP440-P2, or equal.
      GLV-2: Class 125, 200 psi, CWP, screw in bonnet, Teflon disc, soldered ends.
      Manufacturer: Hammond UP418, Milwaukee UP1502, or equal.

D. Piping and fittings:
   1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.
   2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 0553: Plumbing Identification.
      P-1: Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.
      Manufacturer: American Foundry, Tyler, AB & I, or equal.
      PF-1a: Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.
      Manufacturer: American Foundry, Tyler, AB & I, or equal.
      PF-1b: Cast iron, soil or waste, Heavy-duty no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 4 bands for size 5-inch thru 10-inch. IAPMO, ASTM C564 and CISPI 310.
      Manufacturer: American Foundry, Tyler, AB & I, or equal.
      P-4: Copper water tube, Type L hard, ASTM B88. (For above ground use only.)
      Manufacturer: Mueller, Cambridge-Lee, Halstead, or equal.
      PF-4a: Copper Press-Connect pressure fittings, comply with ASME B16.51 "Copper Alloy Press-Connect Pressure Fittings", with Ethylene Propylene Diene Monomer, EPDM O-Ring

Seal in each end. Fittings with the sizes of 2-1/2" and larger shall have cross-section Grab Rings and separation rings.
Manufacturer: Viega, Mueller Industries, Apollo, or equal.
PF-4b: Wrought copper - solder type ANSI B 16.22.
Manufacturer: Mueller Brass, Nibco, Lee Brass, or equal.

P-8: Red seamless brass 85-5-5-5, iron pipe size (IPS), threaded pipe, ASTM B43.
Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.
PF-8: Bronze and brass, 250 psi, threaded, ASA B16.17 and F S WW-P-460.
Manufacturer: Mueller Brass, Lee Brass, or equal.

P-9: PVC, thick wall, cast-iron OD sized, UL, and NSF listed, comply with AWWA C900, and ASTM D1784 Cell Class 12454B, with tracer wire.
Manufacturer: Blue Brute, or equal.

E. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I

PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Domestic Hot and Cold Water, Aboveground	Interior only	P-4	PF-4a, or PF-4b
Waste and Vent – Sanitary / Storm Drain	All sizes	P-1	PF-1a, or 1b
		Refer to 33 3000	Refer to 33 3000

F. Pipe Isolators:
PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe.
Manufacturer: Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator, or equal.
Manufacturer: Hydra-Zorb Cushion Clamps, Acousto-Clamp, or equal.

G. Unions:
1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):
   a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.
   b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.
   c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.
   d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required.
2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:
1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.
2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.
3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the ARCHITECT.
4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.
5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.
6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.
7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the ARCHITECT or indicated on Drawings.
8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.
9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.
10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the ARCHITECT.
11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.
12. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:
1. Provide pipe sleeves Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.
2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

D. Pipe Joints and Connections:
   1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.
   2. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:
      a. Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.
      b. Plastic Piping: Teflon pipe joint compound tape.
      c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.
      d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.
      e. Other services furnish sealant, suitable and as reviewed by the ARCHITECT.
   3. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.
   4. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.
   5. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

E. Copper Tubing and Brass Pipe with Threadless Fittings:
   1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.
   2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.
   3. Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.
   4. Do not overheat piping and fittings when installing silver brazing.
   5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed, and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.
   6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.
   7. Pressed fittings for copper or copper alloy pipe or tubing shall have an elastomeric O-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, mechanically cleaned and reamed prior to joining to remove all burrs (interior and exterior) and restore full inside diameter and a smooth, chamfered exterior surface. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

F. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

G. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.
2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.
3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.
4. Valves for similar service shall be of one manufacturer.
5. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman, or equal.

H. Hangers and Supports:
1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer's Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.
2. Hose faucets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.
3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.
4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.
5. Burning holes in beam flanges or other structural members is not permitted without review by the ARCHITECT and CITY.
6. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.
7. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:
   a. Tolco I beam, Fig.62 for maximum 1000 pounds.
   b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.
8. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:
   a. Tolco Fig.310 for maximum of 600 pounds.
   b. Tolco Fig. 309 for maximum of 1140 pounds.
9. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.
10. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes ½ inch through 2-inch, ½ inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and ¾ inch for 8-inch and 10-inch pipe.
11. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.
12. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.
13. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.
14. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

15. Vertical Piping:
    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.
    b. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.
16. Horizontal Piping:
    a. Domestic cold-water piping, water supply and return piping, with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.
    b. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.
17. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.
18. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.
19. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

END OF SECTION

SECTION 220553

PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:
1. Division 01: General Requirements
2. Section 22 0513: Basic Plumbing Materials and Methods.
3. Section 22 1000: Plumbing.
4. Section 22 2013: Plumbing Piping.

1.2 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.3 QUALITY ASSURANCE

A. Comply with provisions of:
1. Section 22 0500: Common Work Results for Plumbing.
2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.
3. APWA: Uniform Color Code.
4. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.2 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters and marked "Danger"); submit Sample tag to the Architect for review.

2.3 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.4 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.5 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	**Length of Color Field (in inches)**	**Size of Letter (in inches)**
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼

D. Locations:
1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).
2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.
4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.
5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	**Legend**	**Background Color**	**Lettering Color**
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot water 140ºF	Domestic H.W. 140ºF	Blue	Black
Waste	Waste	Green	White
Vent	Vent	Green	White
Storm drain	Storm drain	Green	White

PART 3 – EXECUTION

3.1 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.2 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 220700

PLUMBING INSULATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation for plumbing piping.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Section 22 0500: Common Work Results for Plumbing.
   3. Section 22 0513: Basic Plumbing Materials and Methods.
   4. Section 22 0553: Plumbing Identification.
   5. Section 22 1000: Plumbing.

1.2 REFERENCES

A. American Society for Testing and Materials International (ASTM):
   1. ASTM C302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation.
   2. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
   3. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   4. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
   5. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   6. ASTM C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
   7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   8. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories, Inc.
   1. UL 723 - Test for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. California Code of Regulation Title 24.
   1. California Green Building Standards Code.

1.3 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.
   1. Complete material list of items to be furnished and installed under this Section.
   2. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements.

3. Shop Drawings, catalog cuts and manufacturer's data indicating insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California quality standards for insulating materials.
4. Display sample cutaway sections.
5. Manufacturer's recommended method of installation procedures, which will become part of this Section.

1.4 QUALITY ASSURANCE

A. Qualifications of Manufacturer and Installer, Materials, Fabrication, Execution, and Standard of Quality: Comply with provisions stated under Section 22 0500: Common Work Results for Plumbing and Section 22 0513: Basic Plumbing Materials and Methods.

B. Insulation Work shall be in accordance with the California Building Energy Efficiency Standards, CBC, and Uniform Mechanical Code and the California Green Building Standards Code.

C. Test Ratings:
1. Comply with provisions stated under Section 22 0500 and 22 0513 with emphasis on ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, UL label or listing of satisfactory test results from the National Institute of Standards and Technology, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.
2. Furnish labels, legibly printed with the name of the manufacturer or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for installation. Flame spread index of not more than 25 and smoke developed rating not exceeding 50.
3. Tests shall be performed on each item individually when insulation, vapor barrier covering, wrapping materials, or adhesives are installed separately at the Project site.
4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

D. Regulatory Requirements: Insulation furnished and installed under this Section shall meet minimum legal requirements of the Building Energy Efficiency Standards adopted and incorporated in the California Energy Commission, Title 24, Part 2, Chapters 2 through 53 and the California Green Building Standards Code unless otherwise noted, for the piping,

E. Chemically based products such as sealers, primers, fillers, adhesives, etcetera must meet the California air quality regulations.

1.5 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 22 0500: Common Work Results for Plumbing and 22 0513: Basic Plumbing Materials and Methods.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General:
1. Insulating material shall be fire resistant, non-corrosive, shall not break, settle, sag, pack or disintegrate under vibration, nor absorb more than 1 percent moisture by weight.
2. Insulating material shall be furnished with thickness indicated in Table 1, and shall furnish thermal resistance in the range of R-4.0 to 4.6 in accordance with inch at 75 degrees F. For any other value of R, insulation thickness shall be calculated accordingly and submitted for review.

3. Asbestos in any quantity in insulating material is not permitted.
4. Provide insulation materials, adhesives, coatings, sealants, fitting covers, and other accessories with a fire hazard rating not to exceed 25 for flame spread, 25 for fuel contributed and 50 for smoke developed, except for materials listed as follows:
   a. Nylon anchors for installing insulation to equipment.
   b. Treated wood blocks.
5. Flame-proofing treatments subject to moisture damage are not permitted.

TABLE 1 - MINIMUM PIPING INSULATION THICKNESS (1)

Insulation Thickness Required (in inches)

Piping System Type	Temp. Range (degrees F)	Runouts up to 2 (2)	1 and less	1.25 to 2	2.5 to 4	5 to 6	8 and larger
Service Water Heating Systems (recirculating, piping supply and return)							
Hot Water	Up to 180	0.5	1.0	1.0	1.5	1.5	1.5

NOTES: (1) For piping exposed to ambient temperatures, increase thickness by 0.5 inch.
(2) Runouts to individual terminal units, not exceeding 12 feet in length.

B. Lagging Adhesives: Shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Insulation finished with canvas shall be provided with laps adhered in accordance to manufacturer's recommendation. A finish coat of same material shall be applied to entire outer surface of lagging cloth at coverage specified by manufacturer.

C. Canvas Jackets: Provide 6 ounce, in accordance with square foot minimum, 48 by 48 thread count canvas jacketing.

D. Insulation Jackets:
1. Insulated elbows, of 90 degrees and 45 degrees, with a nominal iron pipe size of ½ inch to 8-inch shall be provided with Childers aluminum Ell-Jacs insulation covers as basis of design, or Pabco, RPR, or equal, manufactured from 1100 aluminum alloy of 0.024 inch thickness. Insulated elbows with a nominal pipe size of 10-inch to 18-inch shall be provided with Childers 4-piece aluminum Ell-Jacs as basis of design, or Pabco, RPR, or equal.
2. Tees, Flanges, and Valve Insulation in Conjunction with Aluminum Jacketing: Furnish Childers Aluminum Special Fabrications Insulation Covers as manufactured by Childers Products Company, Pabco, RPR, or equal.

E. Adhesives: Adhesives shall be water based, UL Classified, meet the requirements of NFPA 90A and NFPA 90B, have been tested according to relevant ASTM requirements, and be acceptable to the State Fire Marshal. Name, type and method of installation shall be submitted for review.

F. Valve and Fitting Cover: When installed in conjunction with PVC jacketing, furnish Zeston 25/50 rated polyvinyl chloride fitting covers as manufactured by Johns Manville, Knauf Insulation, Speedline, or equal.

2.2 DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Insulate domestic hot water supply and return piping, including valves, strainers and fittings with insulation thickness as indicated on Table 1.

B. Materials:
1. Classes of Insulation:
   a. Class A: Glass fiber molded pipe insulation suitable for service temperatures up to 850 degrees F. Pipe insulation shall be one piece, preformed, and provide a minimum R factor of

4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be Johns Manville Micro-Lok, Knauf Redi-Klad 1000, Owens Corning FIBERGLAS Pipe Insulation SSL II-ASJ, or equal.

b. Class B: Flexible open-cell melamine (foam insulation) suitable for service temperature -150 degrees F to 400 degrees F. Thermal conductivity at 75 degrees F, K= 0.26. Pipe insulation, one-piece pre-formed, laminated to heavy non-reinforced PVC jacket, with locking track, factory installed to jacket, to snap insulation and jacket onto pipe. Similar to TechLite 079 Series as manufactured by Accessible Products Co., or equal. Installation shall comply with manufacturers recommendations.

c. Class C: Mineral fiber pipe insulation suitable for service temperatures up to 1200 degrees F. Pipe insulation shall be one-piece, preformed up to 3 inches thick, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be 8 pounds in accordance with cubic foot density by Roxul Techton 1200, Fibrex COREPLUS 1200, Industrial Insulation Group, LLC (IIG) MinWool-1200, or equal.

2. Locations and Class of Insulation Required:

TABLE 2 – LOCATIONS AND CLASS OF INSULATION REQUIRED

LOCATION	CLASS OF INSULATION
Equipment Room	A, B or C
Other Locations	A, B or C

3. Fittings on indoor piping shall be covered with flush, hand-wrapped Class A, B, or C insulation, to match the adjoining pipe insulation and covered with polyvinyl chloride fitting covers: Zeston 2000 25/50 by Johns Manville, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal.
4. Adhesive: Fibrous Adhesive to bond calcium silicate to itself and non-porous surfaces.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Except as specified herein, install material in accordance with recommendations of manufacturer. Do not install insulation materials until tests specified in other sections are completed. Remove foreign material such as rust, scale, or dirt. Surfaces shall be clean and dry. Maintain insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be provided and maintained, insulation shall be installed with a continuous, unbroken moisture and vapor seal. Hangers, supports, anchors, or other projections that are fastened to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Surface finishes shall be extended in such a manner as to protect raw edges, ends, and surfaces of insulation.

D. Pipe insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in the following locations unless otherwise noted:

1. On unions, flanged connections or valve handles.
2 Over edges of any manhole, clean-out hole, clean-out plug, and to restrict opening or identification of access.
3. Over any label or stamp indicating make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.2 INSTALLATION OF DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Domestic hot water, tempered water supply and return piping and condensate return piping, after having been tested, shall be cleaned and insulated.

B. Application: Insulate, domestic hot water supply and return, including tempered supply in accordance with manufacturer's instructions and as specified herein.
1. Install insulation on valve bodies up to valve bonnet. Fill void in saddles, in accordance with Section 22 0513: Basic Plumbing Materials and Methods, with insulation and seal joints.
2. Install insulating material to fittings, valves, and strainers and smooth to thickness of adjacent covering. Leave strainer clean-out plugs accessible. Covers fabricated from polyvinyl chloride shall be furnished.

C. Insulation Jackets in Exposed Indoor Locations:
1. Cover completed insulation with canvas jacket tightly pasted to covering with lagging adhesive. Lap jacket seams 1 1/2-inch minimum. Finish entire jacket with coating of undiluted adhesive.
2. Equivalent factory applied pre-sized, glass fiber reinforced, or glass fiber jackets may be furnished. Seal jacket seams with adhesive in accordance with manufacturer's instructions.
3. Johns Manville Zeston 2000, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal, fitting covers may be furnished, with molded or segmented insulation equal to specified insulation applied to fittings. Secure covers in accordance with manufacturer's instructions.
4. In addition to above requirements, cover exposed insulated piping within a distance of 8 feet above floors with 26 gage galvanized steel jacket. Omit jacket in areas accessible only to maintenance personnel, such as mechanical equipment rooms, utility corridors, accessible pipe tunnels and manholes.

D. Concealed Indoor Locations: Cover insulation over fittings, valves, and strainers with canvas. Provide pipe insulation with factory or field applied standard jacket of 4-ounce minimum canvas, fiberglass cloth, or glass fiber reinforced jacket. Seal jacket laps with adhesive in accordance with manufacturer's instructions.

E. Exposed Outdoors: In addition to canvas or fiberglass cloth cover, pipe insulation exposed to weather shall be provided with an additional 0.016 inches thick aluminum jacket with 2-inch lap connected with one inch hem overlap joint located on side of pipe and turned down to shed water. Jacket shall be strapped 12 inches on center with ½-inch wide stainless-steel strapping and wing seals. Aluminum jacket shall be mitered to fit fittings.

3.3 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.4 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

END OF SECTION

SECTION 221000

PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:
1. Division 01 - General Requirements.
2. Section 07 9200: Joint Sealants.
3. Section 22 0500: Common Work Results for Plumbing.
4. Section 22 0513: Basic Plumbing Materials and Methods.
5. Section 22 0553: Identification for Plumbing piping and Equipment.
6. Section 22 0700: Plumbing Insulation.
7. Section 31 2323: Excavation, Backfill for Utilities.

1.2 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.3 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.4 PRODUCT HANDLING

A. Conform to provisions of Section 22 0513: Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Materials: Refer to Section 22 0513: Basic Plumbing Materials and Methods.

B. Insulation for Piping: Refer to Section 23 0700: Plumbing Insulation.

2.2 FIXTURES AND DRAINS

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:
   1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.
   2. Finished and exposed brass equipment, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:
   1. Fixture traps shall be all cast brass, chromium-plated and polished. (No tubular traps). Exceptions as follows:
      a. Traps that are an integral part of a fixture.
      b. Traps concealed in floors, walls and furring.
   2. Concealed traps and 17 gage tailpieces may be rough brass finish, except as otherwise specified. Furnish chromium-plated and polished cast brass wall flanges with setscrews and chromium-plated and polished brass casing on discharge side of each trap.
   3. Tailpieces shall be not lighter than 17 gage, brass, chromium-plated, and polished. Furnish and install chromium brass plated wall flanges with set screws and chromium-plated 20 gage brass casing on discharge side of each chrome-plated all cast trap.

D. Faucet Handles: Faucet handles shall be solid brass, chromium-plated and polished, and fastened to their stems by Allen type hollow head stainless steel set screws through the side of the handle extending into the stem. Handles with sharp edges or projections shall not be furnished. At accessible fixtures: handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate handles shall be 5 pounds maximum.

E. Fixture Supplies:
   1. Supplies for water heaters shall be unplated rigid copper water tube with threaded adaptors for connections to valves and other threaded connections. All other supplies shall be chromium-plated brass with hospital threads or shall be furnished with fittings and valves, which completely cover threads.
   2. Supplies to water closet tanks, lavatories, and drinking fountains shall be furnished with a NSF 372/61 threaded brass nipple. Exposed unfinished piping shall be sleeved with chrome plated brass or copper cover casing and have an appropriate escutcheon for a clean finished appearance. Angle/straight valve stops shall be female 1/2 IPS (inlet) by 3/8 compression (outlet). Fixture supplies shall be polished chrome-plated, solid supply bulbed end risers with size compatible supply nut connection to fixture and 3/8 O.D. compression nut and ferrule connection to angle stop outlet. Stainless steel flexible braided connectors with re-enforced PVC inner hose are not allowed.
   3. Hot and cold water fitting supply outlet piping serving water closets, lavatories, drinking fountains, faucets, hose bibs, and sillcocks shall be iron pipe size (IPS) brass nipple, and piped in such a manner that through wall water supply outlet piping be removable, size appropriate, and lead free. The use of copper, copper MIP sweat adapters or similar fittings, in lieu of brass nipples is not allowed. The IPS brass nipple shall be directly connected to the fixture as follows:
      a. Control stops for water closet flush valves.
      b. Angle stop for lavatories, sinks and drinking fountains.
      c. Shank/arm adapters for wall mounted sink faucets.
      d. Iron pipe size (IPS) brass nipple connection for hose bibs, sillcocks, and other plumbing related fixture and/or plumbing fitting water supply outlets.

4. Water supply pipe that penetrates a finished surface, wall, countertop or part of a cabinet shall be appropriately sized polished chromium-plated cover casing and wall flange/escutcheon fitting tight to the brass through wall nipple and securely affixed to the finished wall surface.
5. Water supplies of plumbing fixtures shall be protected against back-siphonage in event of a vacuum in piping system. Toilet flush valves shall be furnished with recognized atmospheric vacuum breakers, installed a minimum of 6 inches above fixture.
6. Discharge outlets of supply faucets for lavatories and sinks shall clear top of overflow rim by at least one inch.

2.3 ACCESS PLATES (To cleanouts, valves, water hammer arrestors and hose faucets)

A. Schedule Numbers:
AP-1: Square, unless otherwise noted, steel, prime coated; frame, 18 gage minimum. Door shall be 16 gage minimum with concealed hinge or be removable, with vandal-proof lock operated by Allen wrench. (Specify for painted and stucco walls.)

SMITH	ZURN	ELMDOR	MILKOR	WATTS	MIFAB	JOSAM
Fig 4760 AK	Z-1462-VP	DW-AKL	MOR DW AK1	CO-300-S-6	UA-A	58650-VP OR EQUAL

AP-2: Round type, stainless steel, vandal-proof, 5/16 inch No. 18 or 1/4 inch No. 20 flat-head machine screw into cleanout plug. Plate shall be prime coated minimum 18 gage steel or polished chrome-plated brass, 18-8 No. 302 stainless steel, or polished nickel bronze. (To be specified for painted walls, screwed into cleanout plug.)

SMITH	ZURN	JOSAM	WADE	WATTS	MIFAB	OR EQUAL
4710U	Z-1469-VP	58600	8480R	CO-480-RD-6	C1400-RD-6	

AP-3: Square, polished face chrome-plated bronze, aluminum alloy or brass chrome-plated brass frame with 14 gage polished 18-8 No. 302 stainless steel or brass chrome-plated secured cover with vandal-proof screws. (To be specified for tile walls.)

SMITH	ZURN	WADE	WATTS	MIFAB	JOSAM	OR EQUAL
4735U	Z-1460-VP	58630	CO-300-S-6	C1400-S-3-6	58640-VP	

2.4 CLEANOUT ASSEMBLIES

A. Cleanout plug shall be line size.

B. Schedule Numbers:

CO-1: Iron body cleanout tee full line size up to 4 inches and round access plate, plugs shall be brass, countersunk with tapped boss for 5/16 inch No. 18 or ¼ inch No. 20 screws. (Specify for finished walls at base of waste stack, and service sink.) AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn or equal.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4532-U	Z-1446-BP	CO-460-RD-34B	C1460-RD-6	58600-CO	

2.5 DIELECTRIC UNIONS

A. Schedule Numbers:
1. Dielectric style Unions using ferrous and no-ferrous metals are prohibited. Dielectric flanges are admitted for use – see DU-2.

DU-1: Lead Free Brass union with 6-inch Lead Free Brass nipple.

DU-2: Lead Free Brass union or Lead-Free Brass flanged fittings are to be used in between pipes made of dissimilar metals to prevent accelerated corrosion and deterioration in the piping systems due to galvanic and stray current.

WATTS	WILKINS	ZURN	NIBCO	OR EQUAL
LF3100M3			733-LF	

2.6 FAUCETS

A. Access compliant faucets: Force to activate controls shall be no greater than 5 pounds. Self-closing metering, where specified, to remain open 10 seconds minimum when activated. Handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

2.7 PIPE HANGERS

A. Refer to Section 22 0513: Basic Plumbing Materials and Methods.

B. Schedule Numbers:
1. PH-1: Complete with clamps, inserts, etc.

SUPERSTRUT	UNISTRUT	TOLCO	B-LINE	OR EQUAL

2.8 STOP VALVES

A. Stops shall be loose key type, ½-inches IPS inlet and outlet chrome-plated brass casting, except as noted.

B. Schedule Numbers:

STV-1: Angle:

CHICAGO,	BRASSCRAFT	NIBCO	OR EQUAL
442-LKABCP		77	

STV-2: Partition:

CHICAGO	T& S BRASS	OR EQUAL

1771-ABCP	B-1028	

STV-3: Straight Type, with Loose Key:

CHICAGO	BRASSCRAFT	T&S BRASS	OR EQUAL
45-LKABCP (1/2 inch)		B-O418	

2.9 WATER HAMMER ARRESTORS

WHA-1: Lead Free Water Hammer Arrestor provided for Headers for Lavatories, Wash Sinks, Wash Fountains, Kitchen Sinks, Service Sinks, Urinals and Water Closets. For sizing purposes size according to manufacturer's recommendations.

SIOUX CHIEF	PPP	JR SMITH	WATTS	JOSAM	OR EQUAL
655 and 656 SERIES	SC SERIES	5005 TO 5050 SERIES	Series LF05 and LF15M2	75000	

2.10 FIXTURE CONNECTIONS

A. Branches to individual fixtures shall be of the following sizes (Inches) unless larger sizes are indicated on Drawings:

Fixture	Copper, Cold (Inches)	Copper, Hot (Inches)	Trap and Connections (Inches)	Soil/ Waste (Inches)	Vent (Inches)
Kitchen Sink	1/2	1/2	1-1/2 by 1-1/2	2	1-1/2

2.11 HEIGHT OF FIXTURES

A. Heights for standard fixtures.

Fixture	Adult and High School (Inches)	Secondary (Inches)	Elementary (Inches)	Kindergarten and Younger (Inches)
Sink top height	32	32	30	25

B. Heights for access compliant fixtures.

Fixture	Adult Ages 12 and Over (Inches)	Elementary Ages 6 to 11 (Inches)	Kindergarten and Younger Ages 3 to 5 (Inches)

Lavatories, sink top height	34 maximum	29 maximum	24 maximum
Lavatories, sink knee clearance	27 minimum	24 minimum	19 minimum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Unless otherwise specified, plumbing fixtures, equipment and appliances that require connections to plumbing line shall be connected. This shall include fixtures specified or indicated as furnished by others, furnished by Owner, or specified in other related sections. Install supplies, stops, valves, traps, wall flanges, or pipe casing for connection of this equipment.
   2. Install equipment as indicated on reviewed and accepted Shop Drawings.
   3. Avoid interference with Work of other trades. Do not deviate from Drawings without review of the Architect.

B. Examination: Check each piece of equipment in system for defects verifying that parts are properly furnished and installed.

C. For piping Work, refer to Section 22 0513: Basic Plumbing Materials and Methods.

D. Plumbing Fixture and Equipment Installation:
   1. Unless otherwise indicated, fixtures shall be installed with 5/16 inch brass bolts or screws of sufficient length to securely fasten fixture to backing, wall, or closet ring.
   2. Fixtures installed against concrete or masonry walls shall have their hangers fastened with 5/16 inch brass bolts, Philip Shield type anchors, or 2 unit cinch anchors. Wood or plastic plugs are not permitted.
   3. Fixtures installed against wood or metal stud walls shall have their hangers fastened to metal backing plates with 5/16 inch brass bolts screwed into plate. Fixture hangers for urinals shall be fastened centered vertically on metal backing plate with three 5/16 brass bolts each for small individual hangers and six, for larger one piece hangers. Lavatories shall be hung with not less than four 5/16 inch brass bolts or not less than five 1/4 inch brass bolts. Each sink hanger shall be hung with not less than four 5/16 inch brass bolt or not less than five 1/4 inch brass bolts.
   4. Pan type drinking fountains shall be hung with 5/16 inch cadmium plated bolts with a bolt in each bolt opening in hanger. Hangers for pan type drinking fountains shall provide 2 inches (plus or minus 1/4 inch) between pan and wall. Spaces due to irregularities between fixtures and tile walls shall be neatly filled with white cement or silicone filler.
   5. Backing for hanging of plumbing fixtures and equipment shall be installed in supporting wall at time rough piping is installed. Backing for stud walls shall be steel plate 1/4 inch thick, not less than 4 inches wide. Backing for urinals shall be ¼-inches thick by 6-inch wide steel plate. Steel plate shall be attached to stud at each end of plate and to each stud it crosses. Plate shall be attached to metal studs by bolting with two ¼ inch U-bolts per stud with bolts through plate and around stud flange or by welding with a 1/8 inch fillet weld full width of stud flange, top and bottom of plate. At wood studs, plate shall be carefully recessed flush with face of stud and attached to each stud with

2 No. 14 flat-head wood screws, 2 inches in length into pre-drilled 1/8 inch holes. Backing for stud walls supporting wall-hung closets shall be as detailed.

6. Rough-in for fixtures, equipment and appliances shall be as indicated on Drawings and as specified, including those items indicated as furnished by others, furnished by Owner, or future capacity. When connections to equipment from capped or plugged lines are required, caps or plugs shall be removed at time equipment is set and stops or valves installed and connections provided as specified.
7. Piping materials for trap arms shall be Brass, Cast Iron or DWV copper
8. Piping shall be stubbed out to exact location of fixtures and stubs shall be installed symmetrical with fixtures. Hot and cold water supplies for center set faucets on lavatories shall be installed on 8-inch centers, unless otherwise specified or required.

E. Cleanouts in Drain, Waste, Vent and Sewer Lines:
1. Cleanouts shall be installed at locations stated in the California Plumbing Code and accessible at following locations:
   a. At locations above first floor as stated on construction documents and 5 feet outside of the building.
   b. Not to exceed 100-foot intervals in sewer and waste lines exterior of building.
   c. Where indicated on Drawings.
2. Cleanouts in building shall be extended to floor level or above floor level or above floor level in walls or furring when cleanouts are not accessible or where clearance is less than 18 inches.
3. Cleanouts in finished areas in building shall be concealed except that cleanouts above service sinks in janitor's rooms or closet, and cleanouts above service sinks or in exposed piping in boiler or heater equipment rooms, may be exposed. Cleanouts for urinals shall be installed above urinal and shall terminate behind an access plate.
4. Cleanouts in floors of covered areas and those extended to grade in concrete areas shall be floor level type with extensions body brass plugs and detachable nickel-bronze or aluminum alloy scoriated.
5. Concealed cleanouts in vertical lines shall be service weight soil cleanout tees with brass plugs and round cover plates unless otherwise specified or indicated. A snug fitting sleeve of galvanized sheet metal shall be placed around hub of tee and shall extend to flush with finished soil, or cleanout shall be extended to finished wall.
6. Cleanouts extended from below floor to a wall or furring or on horizontal lines above floor that terminate at a wall or furring shall be iron body type with brass plugs and round cover plates.
7. Cover plates over cleanouts in painted walls shall be steel, bonderized and prime coated. Cover plates cover cleanouts in tile walls shall be chromium-plated brass or nickel bronze. Plates shall be attached to cleanout plugs with 5/16 inch No. 18 or 1/4 inch No. 20 stainless steel vandal-proof type screws. Plates shall be one inch larger in diameter than fitting opening.

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform trenching, excavation, and backfilling required for Work of this section as specified herein and in Section 31 2323: Excavating, Backfilling, and Compacting for Utilities.

3.4 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and provide proper connections.

B. Potable water lines shall be purged completely before connecting to sources of water for the Project. Determine quality of water supply before connection.

3.5 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on Drawings and in following locations (only non-ferrous arrestors may be installed in copper water system):
   1. Water lines to lavatory headers, water closet and urinal headers, service sinks, kitchen sinks, wash fountains, drinking fountains, laboratories with medical type faucets and on wash sinks having three or more stations and all other quick closing fixture such as clothes washers, as close to fixture as possible.

B. When possible, arrestor shall be installed in wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of arrestor. Access plate shall be a minimum of 2 inches larger in each direction than the arrestor.

C. Fixture water lines shall be provided with mechanical water arrestor hammer dampening devices. Air chambers are not approved.

3.6 CLEANING - PLUMBING PIPING SYSTEMS AND FIXTURES

A. Plumbing lines and fixtures shall be flushed to remove dirt and foreign material until water runs clear and no foreign substance or odor is present. Strainers and screens on faucets shall be removed during this cleaning operation.

3.7 DISINFECTING DOMESTIC WATER PIPING SYSTEMS

A. Newly installed or replaced piping and/or fixtures dispensing potable water, and any additional piping and/or equipment impacting the integrity of this system shall be disinfected and undergo an approved bacteriological analysis before water system is allowed for public use.

B. Disinfection shall commence upon complete installation of all related domestic water systems including fixtures, valves, faucets, water heating systems, etc.

C. Work shall be performed by Technicians Certified by the American Water Works Association (AWWA) and/or the State of California Department Health Services, Grade II Water Treatment Operator Certification or higher issued by the Department of Health Services (DHS) for the State of California. Comply with Title 22, Code of Regulations Division 4, Chapter 13, and Article 2 Operator Certification Grades.

D. Method:
   1. A Physical Separation of minimum 6” or Reduced Pressure Backflow assembly shall be installed to protect from cross contamination of the local water purveyor’s meter service supply when at any time there is any type of water connection with the piping to be disinfected (Chlorinated) and the water meter service supply.
   2. Install a Chlorination Port including a T fitting and a shut off valve to the proximity of the point of connection at the new piping system.
   3. System is to be flushed to remove any materials that may have entered the system.
   4. Using a chemical feed metering pump and a chlorine tank, the chlorine solution is injected into the water system.

E. Disinfection and De-chlorination procedure (24 or 3 Hour Contact Time):
   1. 24-hour Test Method:
      a. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, “Water System Being Chlorinated- “Danger Do Not Drink Water” or similar warning.
      b. Piping system shall then be adequately flushed with water to remove any particles and eliminate air pockets.

c. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 50 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.
d. Chlorine residual test will be taken at all appropriate points and outlets to verify 50 PPM residual levels.
e. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 24 hours.
f. After 24 hours, chlorine residual levels will again be tested at various points throughout the system to insure a minimum of 25 PPM residual. If the system has not met the minimum of a 25 PPM residual, the above disinfection process shall be repeated.
g. After satisfactory completion of the residual testing, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.
h. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

2. 3 Hour Test Method:
   a. If the water systems must be turned on for use as soon as possible, a 3 hours chlorine contact time to allow for disinfection is permitted with the OAR's approval.
   b. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated- "Danger Do Not Drink Water" or similar warning.
   c. Piping system shall be then adequately flushed with water to remove any particles and eliminate air pockets. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 200 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.
   d. Chlorine residual test will be taken at all appropriate points and outlets to verify 200 PPM levels. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 3 hours.
   e. After satisfactory completion of a 3 hour disinfection period, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.
   f. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

F. Bacteriological Test:
1. After final flushing and satisfactory results from the residual free chlorine concentration test, Bacteriological test samples shall be collected. The intent of the following is to provide insurance for an accurate representation to a complete Bacteriological test of the water system. At least two samples shall be taken from each floor of each building.
2. Bacteriological test samples shall be delivered to a State of California Department of Health Services Certified Laboratory to perform qualitative and quantitative bacterial analyses on the water samples for the presence of any Total Coliform bacteria and Plate Count. This count must be less than 500 cfu/mL.
3. The procedure shall be repeated if it shown by bacteriological examination made by an approved agency that the level of Disinfection does not meet these specifications.
4. After satisfactory results for the bacteriological test are provided to the OAR, the physical barrier or temporary reduce pressure back flow devise shall be removed, and the new piping shall be connected to the point of connection. All the connecting piping and fittings shall be disinfected prior to installation. Chlorination Port shall be capped watertight. Warning sign or tags shall be removed.

3.8 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:
   1. Lead free complying with AB1953.
   2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

3.9 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of Project site.

3.11 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section provides the basic mechanical requirements that apply to the Work of Division 23.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Division 26: Electrical.

1.2 REGULATORY REQUIREMENTS

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:
   1. AMCA - Air Movement and Control Association.
   2. ANSI - American National Standards Institute.
   3. ASME - American Society of Mechanical Engineers.
      a. ASME Boiler and Pressure Vessel Code.
      b. ASME B31 - Code for Pressure Piping.
   4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute.
   5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
   6. ASTM - American Society for Testing and Materials.
      a. ASTM A53 - Specification for Welded and Seamless Pipe.
   7. CSA - Canadian Standards Association.
   8. FM Global - Factory Mutual Global
   9. IAPMO - International Association of Plumbing and Mechanical Officials.
   10. NFPA - National Fire Protection Association.
   11. OSHA - Occupational Safety and Health Administration.
   12. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
   13. UL - Underwriters Laboratories Inc.
   14. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:
   1. CBC, California Building Code, and CMC, California Mechanical Code.
      a. Latest edition as adopted by the City of Los Angeles, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.
   3. OSHA - Occupational Safety and Health Administration.
   4. CDPH – California Department of Public Health.
   5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 23 sections, as applicable.

B. After Architect's approval, the above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 3113: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 3113 and Section 01 3300 and shall indicate at a minimum:
   1. Complete system layout of equipment, components, ductwork, and piping, indicating service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger / support locations. All the above items shall be coordinated on the shop drawings according to the requirements of Section 01 3113.
   2. Schedule and description of equipment, ductwork, piping, fittings, valves, dampers, and controllers.

1.4 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:
   1. Provide a complete set of mechanical and control system drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and three sets of prints.
   2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:
   1. Submit operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.
   2. Contents of Manual:
      a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.
      b. Manufacturer's operating instructions including, but not limited to, the following:
         1) Identification of components and controls.
         2) Pre-start checklist and start-up procedures.
         3) Normal operation settings and checklists.
         4) Pre-shut down checklist and shut down procedures.
         5) Trouble shooting checklist and guidelines.
         6) Recommendations for optimum performance.
         7) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 23 that includes the following as a minimum:
   1) Manufacturer's model, identification and serial numbers.
   2) Exploded view of assembly drawings identifying each component or part with the relevant part number.
   3) Directory of manufacturer's representatives, service contractors and part distributors.
   4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of mechanical and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 01 4525.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.5 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 23. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.7 PRELIMINARY OPERATION

A. OAR may require any portion of mechanical Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the Project Inspector at least 24 hours in advance of lighting or re-lighting pilots.

1.8 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:
   1. A minimum of 8 hours of on-site overview of the overall Mechanical System.
   2. Refer to Division 23 sections for specific training on each of the components of the Mechanical System.
   3. A minimum of 8 hours of on-site overview identifying location and function of all Control Valves and Actuator assemblies.

4. A minimum of 40 hours of (in classroom) software training for a minimum of 20 LAUSD personnel on EMS/BMS if such systems are utilized in the project. Training shall be conducted at control contractor training facility with computer setup for each person attending.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.9 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. HVAC equipment products from different manufacturers are never identical. Equipment approved as being equal is interpreted as being equivalent in capacity, performance and quality. The dimensions, weight, configuration and utility requirements could be quite different from the equipment used as the basis of design. Due to these differences, additional coordination and adjustments by the Contractor are required. For the equipment to be deemed truly equal, the additional coordination and adjustments by the Contractor should not incur any additional cost to the Owner and any additional labor to the design team.

D. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. All the additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

E. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.1 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.2 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes or ducts pass through, or are located within one inch of any construction element, install a resilient pad, 1/2 inch thick minimum, to prevent contact.

C. Furnish all necessary provisions for recesses, chases, and accesses and provide blocking and backing as necessary for proper reception and installation of mechanical Work.

3.3 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment as indicated on Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.4 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 23, including this Section.

B. Tests required by other sections of the Contract Documents include the following:
   1. Test and balance of mechanical equipment and systems: Refer to Section 01 4525: Testing, Adjusting, and Balancing for HVAC.
   2. Hydrostatic test of boilers: Refer to Section 01 4525: Testing, Adjusting, and Balancing.
   3. Test of smoke and fire detectors: Refer to Division 26: Electrical.

C. Additional tests may be required in the case of products, materials, and equipment if:
   1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

D. Equipment Performance Assurance Tests:
   1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.
   2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.
   3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of heating, ventilating, and air conditioning equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified heating and cooling capacities. If equipment passes, install new filters. If equipment fails, it shall be adjusted and retested until system meets all applicable codes.
   4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.
      a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.
   5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.
   6. Provide electric energy and fuel required for tests.
   7. Final adjustment to equipment or systems shall meet specified performance requirements.
   8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

E. Specific Coordinated Plan for Test and Balance:
   1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.
   2. Prior to final test and balance, mechanical equipment and systems shall be operated and tested as indicated in Paragraph 3.04.F above to demonstrate satisfactory overall operation of the installed systems.
   3. Immediately before starting tests, air filter media shall be cleaned or renewed. Roll-type filters shall be advanced to provide new clean media. Cleanable type media shall be thoroughly cleaned and re-oiled with new, clean oil as recommended by manufacturer if they are of viscous impingement type. Disposable type filters shall be replaced with new filters. Replaceable media shall be replaced with new media.
   4. An accurate means of measuring air flow and temperatures shall be furnished to balance air supply, return, and exhaust systems so uniform temperatures occur in every room and design airflow is obtained through registers, diffusers, and grilles.
   5. Systems shall be adjusted to provide airflows indicated including maximum fresh air and maximum return air. Dampers shall be checked for proper settings and operation. Air and water inlet and leaving temperatures at coils shall be checked. Complete operational data including airflows, room temperatures, fan speeds, motor currents, plenum, and duct static pressures shall be tabulated.
   6. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 23 0513: Basic HVAC Materials and Methods.

3.5 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by mechanical systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.6 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 5000: Construction Facilities and Temporary Controls, the following shall be provided:
   1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.
   2. Protect installed Work.
   3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.
   4. Protect covering for bearings, open connections to tanks, pipe coils, pumps, compressors and similar equipment.
   5. Interior of ductwork shall be maintained free of dirt, grit, dust, loose insulation, and other foreign materials.
   6. Air handling equipment shall not be operated until building is cleaned and air filters are installed.
   7. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.
   8. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas. Refrigerant piping shall be cleaned as specified.

END OF SECTION

SECTION 230553

HVAC IDENTIFICATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Marking and identification required on mechanical piping systems, ducts, controls, valves, apparatus, etcetera.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Section 23 8000: Heating, Ventilating and Air Conditioning Equipment.

1.2 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.3 QUALITY ASSURANCE

A. Comply with provisions of:
   1. Section 23 0500: Common Work Results for HVAC.
   2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.
   3. APWA: Uniform Color Code.
   Or
   4. IAPMO: Uniform Plumbing Code (UPC).

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.2 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.3 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.4 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation	Length of Color Field	Size of Letter
¾ to 1 ¼-inch	8-inch	½-inch
1 ½ to 2-inch	8-inch	¾-inch
2 ½ to 6-inch	12-inch	1 ¼-inch”
8 to 10-inch	24-inch	2 ½-inch”
over 10-inch	32-inch	3 ½-inch

D. Colors: As indicated in schedule.

E. Locations:
1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etc.).
2. Near each valve and branch connection in such accessible piping.
3. At each pipe passage through wall or floor.
4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.
5. At each change in direction.

F. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels, as required by the Project Inspector.

G. Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Air conditioning condensation drain	A/C condensate drain	Green	White

2.5 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

A. Provide identification markers to locate air conditioning equipment above T-bar ceilings. Install 3/4 inch to one inch diameter colored self-adhesive dots to T-bar ceiling grid indicating point of access. The following identification markers shall be recorded on the project record documents:
   1. Fire Damper and Combination Fire/Smoke Fire Damper: Red.
   2. Manual Volume Dampers, Relief Dampers, Motorized Volume Dampers: Blue.
      a. Supply air: Full dot.
      b. Return air: Half dot.
   3. Fan coil unit: Green.
   4. Filter Location if separate from fan coil: Yellow.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.2 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 230593

HVAC TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions, Divisions 01 and all other Division 23 specification sections, apply to this section.

B. Where contradictions occur between this Section and Division 01, and between contract specifications and drawings, the more stringent of the two shall apply. The Owner's Representative shall decide which is most stringent.

1.2 SUMMARY

A. Furnish the services and coordination required for a completely balanced, tested and certified air and water systems including testing and pre-certification of "operating/clean" rooms at as-built condition.

B. The work shall be accomplished by the services of a Contractor-furnished air-balance and testing (TAB) agency that specializes in the balancing and testing of heating, ventilating, and air conditioning systems, to balance, adjust and test air moving equipment, duct mounted smoke detectors, air distribution systems, and water systems as specified.

C. Work to include all HVAC systems serving.

D. Coordinate with HVAC and control contractors for additional testing required.

1.3 TOTAL SYSTEM BALANCE

A. Performance Testing and/or Balancing of the Air Conditioning Include:
   1. Fan systems.
   2. Single duct systems.
   3. Duct leakage testing
   4. Temperature control systems.
   5. Report analysis and verification.
   6. NOTE: Sections referred to herein are detailed in the current edition of The National Standards Manual of the Associated Air Balance Council.

1.4 SUBMITTALS

A. First Submittal:
   1. Submit three (3) copies of documentation to confirm compliance with quality assurance provisions:
      a. Organization, supervisor and personnel training, and qualifications.
      b. Specimen copy of each of the report forms proposed for use. Forms shall be equivalent to those shown in the latest "National Standards for the Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" of the AABC.
   2. General plan of testing procedures and sequences.

B. Second Submittal: With the initial HVAC shop drawing and at least sixty (60) days prior to starting field work, submit three (3) copies of:
   1. A set of report forms filled out as to the design flow values and the installed equipment pressure drops, and the required CFM for air terminals.
   2. A complete list of instruments proposed to be used, organized in appropriate categories, with data sheets for each. Show:
      a. Manufacturer and model number.
      b. Description and use when needed to further identify the instrument.
      c. Size or capacity range.
      d. Latest calibration date.
   3. A detailed description of the balancing and testing procedures. These procedures shall conform to AABC requirements and recommendations.
   4. Owner's Representative will review submittals for compliance with Contract Documents, and will return one set marked to indicate:
      a. Discrepancies noted between data shown and Contract Documents.
      b. Additional or more accurate instruments required.
      c. Requests for re-calibration of specific instruments.
      d. Expansion or abbreviation of the test procedures and sequences.

C. Third Submittal: The testing agency shall perform the tests described, compile the test data, and submit seven (7) copies of the complete test data to Contractor for forwarding to Owner's Representative for approval within (10) working days of completion.
   1. Report shall contain, at minimum, the following:
      a. Project cover sheet.
      b. Project summary/general comments.
      c. Log data and reference records.
      d. Calibration certificates for all test equipment used on project including model and serial number.
      e. Drawings: The Air Balance Agency shall prepare a complete set of full-scale drawings showing actual duct runs and outlet/inlet locations. Drawings shall be keyed to and furnished with the Air Balance Report. The HVAC design drawings are not acceptable for this purpose. Drawings shall be in AutoCAD latest version.
      f. AABC National Performance Guaranty.
   2. Submit Test and Balance Agency qualifications per Paragraph 1.03A herein, within 30 days after notice to proceed.

1.5 QUALITY ASSURANCE

A. Testing Agency (General and HVAC Systems):
   1. All Work by this agency shall be done under direct supervision of a qualified balancing and testing professional certified by AABC. All instruments used by this agency shall be accurately calibrated and maintained in good working order. Testing procedure shall be as specified in PART 3 – EXECUTION, herein. The tests shall be conducted in the presence of Owner's Representative and Owner's HVAC Inspector.
   2. Total System Balance shall be performed by an independent, non-affiliated agency certified by the Associated Air Balance Council (AABC) which specializes in and whose business is dedicated to testing, adjusting and verification of the HVAC system performance.
   3. The submittal of reports shall be timely upon completion of work. This work shall conform to AABC specifications referred to in the AABC National Standard and other criteria as set for the in this specification.
   4. The Contractor shall procure the services of an independent testing and balancing agency, with previous consent of the District Representative. The Testing and Balancing Agency shall specialize in testing and balancing of heating, ventilating, air-moving equipment, air-conditioning system and Hydronic systems. The testing agency shall provide proof of having successfully completed at least five projects of similar size and scope and shall be a certified member of the Associated Air Balance

Council and/or National Environmental Balancing Bureau, unless otherwise approved. The Mechanical Contractor shall award the test and balance contract to the selected agency as soon as possible after approval of the agency by the District Representative.

5. Furnish written proof that testing agency has not been called before the AABC Board or placed on probation at any time during the past five (5) years.

B. In addition to testing requirements set forth herein, the Owner's Representative will randomly select and direct the Contractor to test 10% of the diffusers, grilles, air handling equipment or devices to confirm the system has been properly balanced in accordance with the contract documents. It is the Owner Representative's discretion that the system(s) and/or devices shall be rebalanced at no additional cost if the random testing indicates that the selected air devices or equipment does not meet the design airflows.

1.6 PRODUCT CONDITIONS

A. General:

1. Notify Owner's Representative when any test is ready to be performed. Owner's Representative is to be present for all tests including air balance.
2. Furnish all equipment required for testing including fittings for additional openings and all openings required inside and outside the building.
3. After the inspection has been approved, or portions thereof, certify in writing the time, date, name and title of the person approving the test. This shall also include the description and what portion of the system has been approved. The person making the inspection shall sign the certification.
4. A complete record shall be maintained of all testing that has been approved and shall be made available at the Project site to all authorities concerned.
5. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to Owner's Representative.
6. Defective work or material shall be replaced or repaired as necessary at no additional cost to Owner and the inspection and test repeated at Contractor's expenses. Repairs shall be made with new materials. No caulking of screwed joints or holes will be acceptable.
7. Isolate all equipment subject to damage from test pressure. Make no test against a service valve or meter.

B. Timing of Tests: Two weeks before expected completion date, put all systems and equipment into operation and continue operation of same during each working day, but not less than five 8-hour periods, until demonstration of all adjusting, balancing and testing has been approved.

C. Functional Tests: Any installed item not meeting the schedule or specified performance shall be removed and replaced with items whose performance is in accordance with the Drawings and Specifications at no additional cost to Owner.

D. After all systems have been completely installed, connections made and tests completed, make arrangements with Owner's Representative to operate the systems for a period of ten (10) working days during the hours of a normal working day.

E. Notify Owner's Representative in writing when the operational period may start and the time for this period shall be scheduled by mutual agreement.

F. During this operation period, instruct Owner's operating personnel in accordance with written instructions of the Service Manual specified.

G. Perform tests as specified and as requested by Owner's Representative to prove installation is in accordance with Contract requirements. Perform tests in presence of Owner's Representative, and furnish test equipment, facilities, and technical personnel required to perform tests.

H. Coordination: Promptly report to Owner's Representative any deficiencies noted during performance of services. Contractor shall rectify these deficiencies, and any tests interrupted shall be re-done at no additional cost to Owner.

I. Test Failures: Notify General Contractor to repair duct system if test pressure and leakage is not attained. Repairs and sealing to be done with sheet metal and sealant by HVAC Contractor Division 23.

1.7 WORK BY HVAC SUBCONTRACTOR

A. Preparation: Before any testing or balancing operations are started, the HVAC Subcontractor shall adjust belts and sheaves, align parts, oil and grease bearings in accordance with manufacturer's instructions, clean exterior surfaces of coil tubes and fins, flush interior of coil tubes until clean and check mixing damper operation to insure free operation and activation by correct thermostat. Install filters and startup equipment.

B. Certification: HVAC Subcontractor shall certify in writing that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but HVAC Subcontractor's certification that prime movers, fans, pumps, refrigeration machines, boilers, etc., are installed in good working order, and full load performance has been preliminarily tested under certification of HVAC Subcontractors. Before any testing and balancing is started, a complete report shall be sent to the Agency. Refer to Part 4 of this Section for Checklist forms to be completed by the HVAC Subcontractor.

1.8 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - EXECUTION

2.1 GENERAL

A. The Test and Balance Agency (TAB) shall be provided with:
1. Within thirty (30) days after agency selection:
    a. Construction drawings
    b. Equipment Specification
    c. Written contract
        1) As Issued or Received:
            a) Change orders.
            b) Equipment manufacturer's submittal data.
            c) HVAC shop drawings.
            d) Temperature control drawings.
            e) Project Schedule.
            f) Completely operable system.
2. Before testing and balancing is started, the HVAC installer shall, adjust belts and sheaves, align all parts, oil and grease bearings in accordance with manufacturer's instructions, clean exterior surfaces of coil tubes and fins, flush interior of coil tubes until clean and check damper operation to ensure free operation and activation by the correct thermostat.

3. Submit written certification by the HVAC Installer that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but the HVAC Installer's certification that the prime movers, fans, pumps, refrigeration machines, boilers, etc. are installed in good working order, and the full load performance has been preliminarily tested under the certification of the HVAC Installer. Before any testing and balancing is started, a complete report shall be sent to the Test and Balance Agency. Refer to Part 4 herein for Hydronic and Air Handling System Checklists.
4. Make all modifications to rectify discrepancies reported by the Balancing Contractor as indicating non-compliance with the Contract Documents.
5. The air system shall be adjusted to obtain the air volumes specified but readjusted if required to obtain design temperature in each room. Make drive changes, install additional dampers, vanes, grille baffles, etc., as may be required on the job to achieve correct operation and design conditions.

2.2 BALANCING

A. Air Systems:
1. Preparation of Duct System:
   a. All supply and return air duct dampers are set at full open position.
   b. All diffuser and sidewall registers are set at full open position.
   c. Outside air damper is set at minimum position.
   d. All controls checked and set for full cooling cycle.
   e. Branch line splitter dampers to open position.
   f. Set all extractors and distribution grids to wide-open position.
2. Preparation Heat Pump package unit:
   a. Drill all probe holes for static pressure readings, pitot tube traverse readings and temperature readings.
   b. Check motor electrical current supply and rated-running amperage of fan motors.
   c. Check available adjustment tolerance.
3. Main Duct Proportioning:
   a. Make first complete air distribution run throughout entire system, recording first run statistics.
   b. Using pitot tube traverse in all main duct and branch duct supply and return, proportion all air in required amounts to the various main duct runs and branch runs.
   c. All fan systems with filters shall be balanced to the air flows as shown on the drawings based on the filter final pressure drop as shown on the equipment schedule. Apply an artificial pressure to match the filter final pressure drop. Balance the airflows to the quantities as shown on the drawings. Make readings and record on report. Remove the artificial pressure drop.
   d. Make second complete air distribution run throughout entire system for check on proper proportion of air.
4. Inlet and Outlet Proportioning:
   a. Using pitot tube traverse, set all main line dampers to deliver proper amount of CFM to all areas.
   b. Using pitot tube traverse, set all branch line dampers to deliver proper amount of CFM to diffusers and sidewall supply grilles in each zone.
   c. Read CFM at each outlet and adjust to meet requirements.
   d. Test and record all items as listed (Testing Procedure).
5. Testing Procedure for Air Systems:
   a. Test and adjust blower RPM to design requirements.
   b. Test and record motor full load amperes.
   c. Make pitot tube traverse of main supply ducts and obtain design CFM at fans where applicable.
   d. Test and record system static pressures, suction and discharge.
   e. Test and adjust system for design recirculated air CFM.
   f. Test and adjust system for design CFM outside air.
   g. Test and record entering air temperatures. (D.B. heating and cooling.)

h. Test and record entering air temperatures. (W.B. cooling.)
i. Test and record leaving air temperatures. (D.B. heating and cooling.)
j. Test and record leaving air temperatures. (W.B. cooling.)
k. Adjust all main supply and return air ducts to proper design CFM.
l. Adjust all zones to proper design CFM supply and return.
m. Test and adjust each diffuser, grille and register to within 10% of design requirements. Supply, return, and/or exhaust air quantity relationship shall be maintained as shown on drawings so that the room will maintain the proper air pressurization (positive, negative or equal).
n. Each grille, diffuser and register shall be identified as to location and area.
o. Size, type, and manufacturer of diffusers, grilles, registers, and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.
p. Readings and tests of diffusers, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
q. In cooperation with control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated or noted.
r. All diffusers and registers shall be adjusted to minimize drafts in all areas.
s. As a part of the Work, the HVAC installer shall make all changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance, as recommended by the Air Balance Agency, at no additional cost to Owner.
t. Provide static pressure profile for air handling units showing pressure drop of individual internal component sections (e.g., coil, filter, sound traps, inlet and discharge sections, etc.).

2.3 SPACE DIFFERENTIAL PRESSURE MEASUREMENTS

A. Measure space pressures and make necessary adjustments to achieve differential pressure relationships shown on the drawings.

B. HVAC Installer is responsible for providing all sheet metal blank off plates or other devices as directed by TAB Agency to achieve necessary pressure differentials between clean room and service chase openings. Appearance of all Architectural devices are to be approved by the Architect and Owner Representative whenever visible from occupied lab spaces.

C. Pressure measurements are recorded in inches water gauge.

2.4 TESTING PROCEDURE FOR DUCT MOUNTED SMOKE DETECTORS

A. When air system testing and balancing is completed, the balance agency shall verify proper location and operation of duct mounted smoke detector. Smoke detectors shall be installed per NFPA 72 and the manufacturer's recommendations.

2.5 DUCT PRESSURE/LEAK TESTING

A. Test shall be in accordance with of the National Standards Manual of the Associated Air Balance Council.

B. HVAC Contractor to close off and seal all openings in the duct section to be tested as specified by the Air Balance Contractor.

C. Test duct in sections, not exceeding 150 feet for horizontal ducts and 100 feet for vertical risers.

D. Each section shall be tested at the duct pressure classification. Total allowable leakage should not exceed 2% of the total CFM design for that section being tested.

E. Contractor shall conduct leakage test on ductwork and the Test and Balance Agency shall witness and certify all tests. Tests shall be performed prior to installing ductwork insulation.

F. Pressure test all medium pressure ductwork (pressure class of 3" and higher) prior to installation of insulation.

G. Pressure test all ductwork starting at fan discharge, to inlet of air terminal units.

H. Pressure test all ductwork concealed in shafts or rated enclosures regardless of pressure class.

I. Pressure test all ductwork, supply, return, exhaust, and outside air, regardless of pressure class, that are associated with the smoke control system.

J. Systems shall be inspected and tested to positive pressures, in accordance with the following:
   1. There are no visible HVAC defects.
   2. There is no audible leakage at any point when area ambient noise is at normal-occupancy level.

K. Leak Tests: Test apparatus and procedures shall be similar in all respects to those defined in AABC standards. Filtered blower inlet and automatic safety relief device shall be provided to protect system.

L. Complete testing after the installation of all tapoffs, fire dampers, motorized dampers, access doors, etc., but before installation of terminal air devices. Provide temporary blankoffs at all takeoffs. Complete the testing before shaft is closed up.

M. If leakage exceeds allowable limits correct the deficiency in ductwork and retest the system until leakage is within acceptable limits.

2.6 DETAILED REQUIREMENTS

A. Furnish Typewritten Data for all Fans Tabulating:
   1. Quantity of air in CFM at each air outlet or inlet.
   2. Dry and wet bulb temperatures at each thermostat to the nearest 1/10 of 1 degree.
   3. Outdoor dry and wet bulb temperatures, wind direction and velocity, and barometric pressure at the time tests are conducted.
   4. RPM of fan or blower.
   5. RPM of motor.
   6. Ampere input of each motor (one reading on each leg if three (3) phase).
   7. No load Amperage and brake horsepower calculations on all motors 1/2 horsepower or larger.
   8. Static pressure in inches water gauge at inlet of fan or blower.
   9. Duct traverse data.

2.7 REPORT

A. Provide a General Information Sheet Listing:
   1. Instruments used and most recent calibration date.
   2. Method of balancing.
   3. Altitude correction.
   4. Manufacturer's performance data for all air devices used.

B. The Test and Balance Agency shall prepare and submit six (6) copies of the Test and Balance Analysis Report within ten (10) working days of completion.

C. Report to Contain , at Minimum, the Following:
   1. Project cover sheet.

2. Project summary/general comments.
3. Log, data and reference records.
4. Calibration certificates for all test equipment used on project including model and serial number.
5. Drawings. The Air Balance Agency shall prepare a complete set of full scale drawings showing actual duct runs and outlet/inlet locations. Drawings shall be keyed to and furnished with the Air Balance Report. The HVAC plans are not acceptable for this purpose. Drawings shall be in Auto Cad Latest Version or as approved by the Owner's Representative.
6. AABC National performance guaranty.

2.8 ACCEPTANCE TEST OF HVAC SYSTEMS

A. Perform at least two (2) operational tests of the entire HVAC system.

B. Give each element of the system an operating test of not less than 48 hours' duration to demonstrate to the satisfaction of the Owner that the control system is functioning properly and that the system is capable of producing the required environmental conditions. During this test, operate the system entirely on automatic control and take periodic readings of the inside and outside wet and dry bulb temperatures. Obtain wet and dry bulb temperatures with a recording thermometer-hygrometer. Conduct tests with outside temperature and humidity conditions as near design conditions as practical.

C. Notify Owner seven (7) days in advance of proposed tests.

D. Record temperature and humidity at an exterior and interior location for each system as designated by the Engineer at least once every hour, for 48 hours during tests.

E. Submit a Report Detailing the Following:
1. Instrument used:
2. Most recent calibration date
3. Date of tests.
4. Description of test apparatus locations and methods.
5. Results of tests.
6. Any abnormal usage of the building or abnormal system characteristics observed during the course of the test.

F. Duct Leakage Tests:
1. Seal all openings in duct section to be tested.
2. Connect test apparatus to test section of duct using a flexible duct connection or hose.
3. Close damper or blower suction side to prevent excessive buildup of pressure.
4. Start blower and gradually open damper on suction side of blower.
5. Build up pressure in duct test section between air handling unit and air terminal units to the level of the duct pressure classification.
6. Read the flow meter and compare the leakage in cfm per square foot with the allowable rate. If it meets the allowable rate, proceed to step (11). If it does not meet the allowable rate, follow steps (8), (9), (10) and (11).
7. Inspect the pressurized duct for all sensible leaks. Mark location of each leak.
8. Depressurize and repair all visual and audible leaks.
9. Upon completion of repairs, retest until leakage rate is acceptable.
10. Complete test report on air leakage test summary form. Remove temporary blankouts and seals.
11. Each tested duct section shall be certified by the field test inspector. Provide a certified report at the end of the project. At a minimum, the report shall include a certification letter certifying that all the tested sections have met the requirement, test data, results, and tested dated, technician name(s) that performed the tests, and drawings indicating the test sections.

2.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 31 13

HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Flush flat seam rectangular ducts and fittings.
4. Sheet metal materials.
5. Flexible Ducts.
6. Insulated flexible ducts.
7. Casings.
8. Duct Sealants and Gaskets.
9. Hangers and Supports.
10. Seismic Restraint Devices.

1.2 REFERENCES

A. ASTM International: Provide appropriate references.

B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Air Duct Leakage Test Manual.
2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with the latest edition of the City of Los Angeles Mechanical Code and SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" section of this specification.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in the Code. Subject to compliance, SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" may be followed.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:
   1. Sealants and gaskets.
   2. Other factory made items specified herein.

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   3. Elevation of top and bottom of ducts.
   4. Dimensions of main duct runs from building grid lines.
   5. Fittings.
   6. Penetrations through fire-rated and other partitions.
   7. Equipment installation based on equipment being used on Project, including curbs and bases.
   8. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

C. Delegated-Design Submittal:
   1. Factory- and shop-fabricated ducts and fittings min. scale 1/4".
   2. Reinforcement and spacing.
   3. Seam and joint construction.
   4. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
   5. Sheet metal thicknesses.
   6. Joint and seam construction and sealing.
   7. Reinforcement details and spacing.
   8. Materials, fabrication, assembly, and spacing of hangers and supports.
   9. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire-rated construction.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Perimeter moldings.

E. Welding certificates.

F. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. McGill AirFlow LLC.
      b. SEMCO Incorporated.
      c. Spiral Manufacturing Co., Inc.

2.3 FLUSH FLAT SEAM RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class, except use sheet metal 2 gauge numbers heavier than required for classification with normal standing seam construction.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with the City of Los Angeles Mechanical Code and SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: minimum G60 or minimum G90 for exposed ductwork.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

D. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

E. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 FLEXIBLE DUCTS

A. Manufacturers:
1. Flexmaster USA, Inc.
2. Hart & Cooley Inc.
3. Casco

B. Product Description: Two ply vinyl film supported by helical wound spring steel wire.
1. Pressure Rating: 1.5 inches water gauge (WG) positive and 0.5 inches WG negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -10 degrees F to 160 degrees F.

2.6 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
1. Flexmaster USA, Inc.
2. Hart & Cooley Inc.
3. Casco

B. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
1. Pressure Rating: 1.5 inches WG positive and 0.5 inches WG negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -10 degrees F to 160 degrees F.
4. Thermal Resistance: Comply with ASHRAE 90.1-2013 or most recent version.

2.7 CASINGS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for required operating pressures.

B. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection. Furnish clear wire glass observation ports, minimum 6 x 6 inch size.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch WG, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer, 1/8 inch thick of width to match angle connection.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Duct Attachments: All duct attachments and anchors to structure shall be designed and selected to meet Code requirements.

E. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Galvanized-steel shapes and plates with protection against dissimilar metals.
3. Supports for Aluminum Ducts: Aluminum or galvanized-steel shapes and plates with protection against dissimilar metals.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Install round ducts in maximum practical lengths.

B. Install ducts with fewest possible joints.

C. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

D. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular

to building lines.

E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

F. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

G. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

H. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

I. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

J. Ducts that traverse smoke zones shall be fabricated of sheet metal gauges conforming to NFPA 90A.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

L. Duct Openings:
1. Provide openings in ducts where required to accommodate thermometers, smoke detectors, control devices, sensors, and devices. Install same though airtight rubber grommets.
2. Provide pilot tube openings where required for testing of systems. Each opening shall be complete with a metal cap, with a spring device or screw to ensure against air leakage.
3. At openings in insulated ducts, install insulation material inside metal ring.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction, at junctions and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 INSTALLATION OF DUCTS OUTDOORS

A. Ducts shall be made completely watertight.

B. Construct ducts as follows to assure water run-off.
1. Arrange standing seams so as not to act as dams.
2. Erect ducts with longitudinal seams at bottom of duct.
3. Slope entire top of duct down towards side.
4. Provide vertical struts within duct to bow tap panels of duct into convex shape.
5. Erect ducts with mastic sealant within sheet metal joints.

3.5 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch WG and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch WG: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch WG and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch WG: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection. Extend strap supports down both sides of ducts and turn under bottom at least 1 inch. Secure hanger to sides and bottom of ducts with sheet metal screws.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Avoid penetrations of ducts. Provide airtight rubber grommets at unavoidable penetrations of hanger rods.

3.7 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
   1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Owner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to

which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and hot-dip galvanized or stainless- steel anchors for applications exposed to weather.

3.8 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
    a. Ducts with a Pressure Class Higher Than 3-Inch WG: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 DUCT CLEANING

A. Clean new ductwork that fails the cleanliness test before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
   1. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   2. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   3. Coils and related components.
   4. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   5. Supply-air ducts, dampers, actuators, and turning vanes.
   6. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
   3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
   4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
   5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
   6. Provide drainage and cleanup for wash-down procedures.
   7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.12 START UP

A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

B. Comply with Commissioning requirements.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Back-draft dampers.
2. Backdraft and pressure relief dampers.
3. Barometric relief dampers.
4. Combination fire/smoke dampers.
5. Duct access doors.
6. Static fire dampers.
7. Ceiling fire dampers.
8. Volume control dampers.
9. Flexible duct connections.
10. Dial thermometers.
11. Static pressure gauges.
12. Motorized control dampers.
13. Louvers.
14. Air flow measuring stations.
15. Turning vanes.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air- Conditioning Systems.
3. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors' National Association:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
1. UL 555 - Standard for Safety for Fire Dampers.
2. UL 555C - Standard for Safety for Ceiling Dampers.
3. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

A. Product Data: Submit data for shop fabricated assemblies and hardware used.

B. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Combination Fire-Smoke dampers including locations and ratings.
   3. Backdraft dampers.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

C. Product Data: For fire dampers and combination fire/smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

D. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke/Fire Dampers.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. Ruskin.
   3. Pottorf.

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16-gauge thick steel, or extruded aluminum. Blades, maximum 6-inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90- degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc
   2. Ruskin
   3. Pottorf.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 2-inch WG (0.5 kPa).

E. Frame: 0.063-inch- (1.6-mm-) thick extruded aluminum, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.050-inch- (1.2-mm-) thick aluminum sheet noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:
   1. Material: Stainless steel.
   2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:
   1. Adjustment device to permit setting for varying differential static pressure.
   2. Counterweights and spring-assist kits for vertical airflow installations.
   3. Electric actuators.
   4. Chain pulls.
   5. Screen Mounting: Front mounted in sleeve.
      a. Sleeve Thickness: 20-gauge (1.0-mm) minimum.
      b. Sleeve Length: 6 inches (152 mm) minimum.
   6. Screen Mounting: Rear mounted.
   7. Screen Material: Aluminum.
   8. Screen Type: Insect.
   9. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.
   2. Ruskin.
   3. Pottorf.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 2-inch WG (0.5 kPa).

E. Frame: 0.063-inch- (1.6-mm-) thick extruded aluminum, with welded corners and mounting flange.

F. Blades:
   1. Multiple, 0.050-inch- (1.2-mm-) thick aluminum sheet.
   2. Maximum Width: 6 inches (150 mm).
   3. Action: Parallel.
   4. Balance: Gravity.

5. Eccentrically pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Galvanized steel.

I. Tie Bars and Brackets:
1. Material: Aluminum.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Stainless steel.

L. Accessories:
1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Air Balance, Inc.
2. Ruskin.
3. Pottorf.

B. Fire Resistance: 1-1/2 hours or 3 hours; conform to UL 555.

C. Leakage Rating: Class I, maximum of 8 cfm at 4 inches WG differential pressure.

D. Damper Temperature Rating: 250 degrees F.

E. Frame: 16 gauge, galvanized steel.

F. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 14-gauge equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

G. Bearings: Stainless steel pressed into frame.

H. Seals: Silicone blade edge seals and flexible stainless-steel jamb seals.

I. Linkage: Concealed in frame.

J. Release Device: Close in controlled manner and allow damper to be automatically reset.

K. Actuator:
1. Type: Electric 120 volt, 60 hertz, two-position, fail close or Electric 24 volt, 60 hertz, two-position, fail close as shown on drawings.
2. Mounting: External or Internal.

L. Fusible Link Release Temperature: 165 degrees F.

M. Finish: Mill galvanized.

N. Factory installed sleeve and mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

2.5 DUCT ACCESS DOORS

A. Manufacturers:
1. American Warming and Ventilating.
2. Pottorf.
3. McGill.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1-inch thick insulation with sheet metal cover.
1. Less than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Furnish two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches.
4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

2.6 FIRE DAMPERS

A. Manufacturers:
1. Air Balance, Inc.
2. Ruskin.
3. Pottorf.

B. Fire Rating: UL 555 classified, curtain type, and labeled as a 1-1/2 or 3-hour static fire damper.

C. Air Flow Rating: UL approved for dual directional air flow.

D. Integral Sleeve Frame: Minimum 20 gauge by 12 inches roll formed, galvanized steel.
1. Factory Sealant: Apply to dampers in HVAC systems with pressures to maximum 4 inches WG.

E. Blades:
1. Style: Curtain type, in airstream.
2. Action: Spring or gravity closure upon fusible link release.
3. Orientation: Horizontal.
4. Material: Minimum 24-gauge roll formed, galvanized steel.

F. Closure Springs: Type 301 stainless steel, constant force type, if required.

G. Temperature Release Device:
1. Fusible link, 165 degrees F.
2. Mounting: Vertical or Horizontal as shown on the drawings.

H. Finish: Mill galvanized.

I. Picture Frame Mounting Angles:
   1. One-piece, roll formed retaining angles as detailed.
   2. Factory matched and shipped attached to damper.

2.7 CEILING FIRE DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. Ruskin.
   3. Pottorf.

B. Fire Rating: UL 555C classified and labeled as a 1-1/2-hour ceiling damper.

C. Air Flow Rating: UL approved for dual directional air flow.

D. Frame: Galvanized steel with roll formed ridge for blade stop.

E. Blades:
   1. Style: Two-piece, single-thickness with blade insulation, hinged in center, and held open with fusible link.
   2. Action: Butterfly.
   3. Orientation: Horizontal.
   4. Material: Minimum 20-gauge galvanized steel.

F. Hinge: Spring stainless steel, mechanically attached to blades.

G. Mounting: Horizontal.

H. Temperature Release Device: Fusible link, 165 degrees F.

I. Finish: Mill galvanized.

J. Performance Data:
   1. Pressure Drop: Maximum 0.1 inches w.g. at 500 fpm across 18 x 18-inch damper.

K. Fusible Volume Adjust: UL classified.

2.8 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. Ruskin.
   3. Pottorf.

B. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches size in both dimensions, and two gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4-inch diameter rod in self-aligning, universal joint action, flanged bushing with set screw.
   4. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

D. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.9 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Duro Dyne Inc.
2. Vent fabrics.
3. Ward Industries

B. Connector: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz. per sq. yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3-inch-wide, 24-gauge galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55-inch-thick, 0.87 lbs. per sq. ft., 10 dB attenuation in the 10 to 10,000 Hz range.

2.10 DIAL THERMOMETERS

A. Manufacturers:
1. Ashcroft.
2. Trerice.
3. Watts.

B. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
1. Size: 3-inch diameter dial.
2. Lens: Clear Lexan.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

2.11 STATIC PRESSURE GAUGES

A. Manufacturers:
1. Ashcroft.
2. Trerice.
3. Watts.

B. Dial Gauges: 3-1/2-inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.

C. Inclined Manometer: Plastic with red liquid on white background with black figures, front calibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4-inch diameter tubing.

2.12 MOTORIZED CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by BAS vendor or one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Ruskin Company.
3. Pottorf.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
1. Hat shaped.
2. Stainless-steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

D. Blades:
1. Multiple blades with maximum blade width of 8 inches (200 mm).
2. Opposed-blade design.
3. Stainless steel.
4. 0.064 inch (1.62 mm) thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- (13-mm-) diameter; stainless steel; blade-linkage hardware of zinc- plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg. F (minus 40 to plus 93 deg. C).

F. Bearings:
1. Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch WG (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.
4. Damper Motors: Modulating action.

2.13 LOUVERS

A. Connect to louvers furnished under General Construction work.

2.14 AIR FLOW MEASURING STATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ruskin, IAQ Measuring Damper, Model AML3.

2. Air Monitor Corp.
3. Wetmaster Co.

B. Description: Factory fabricated unit with casing, velocity traverse section and sensors, companion volume meter, and interconnection to volume meter. Air monitoring station must be accurate within 5% between 350 and 400 fpm free area velocity. Air flow resistance not to exceed 0.04” WG at 1000 fpm face velocity.

C. Casing: 0.064 inch (1.62 mm) thick welded galvanized sheet steel, with flanged ends to match connecting ductwork.

D. Velocity Traverse Section:
1. Copper static pressure sensors.
2. Copper total pressure sensing manifolds and control averaging manifold.
3. Operation: Equalizing and integrating all sensor measurements into one total pressure and one static pressure metering port.
4. Sensors positioned on equal-area traverse principle.
5. Aluminum honeycomb air straightener.

E. Volume Meter:
1. Dry dial and diaphragm-actuated type.
2. Calibrated in CFM (cu cm/sec) and FPM (m/s).
3. Provided with mounting bracket.

F. Install nameplate for each station to indicate:
1. Unit size and unit designation.
2. Design air quantity.
3. Design air flow.
4. Design air velocity.

2.15 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Metalaire.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized steel, aluminum or stainless-steel sheet, to match duct material; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

PART 3 - EXECUTION

3.1 INSTALLATION.

A. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside.

B. Access Doors:
1. Install access doors at the following locations:
a. On both sides of duct coils.
b. Upstream and downstream from duct filters.
c. At outdoor-air intakes and mixed-air plenums. d. At drain pans and seals.
e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
g. At each change in direction and at maximum 50-foot spacing.
h. Upstream and downstream from turning vanes.
i. Upstream or downstream from duct silencers.
j. Control devices requiring inspection, including smoke detection heads.
k. At fan bearings enclosed in ducts.
l. Inlet side of each single width centrifugal fan.
m. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.
2. Install access doors with swing against duct static pressure.
3. Access Door Sizes:
a. One-Hand or Inspection Access: 8 by 5 inches.
b. Two-Hand Access: 12 by 6 inches.
c. Head and Hand Access: 18 by 12 inches.
d. Head and Shoulders Access: 21 by 14 inches.
e. Body Access: 25 by 14 inches.
f. Body plus Ladder Access: 25 by 17 inches.
4. Label access doors according to Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
5. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2-inch-high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

C. Flexible Connectors.
1. Install flexible connectors at duct connections to equipment, at building expansion joints, at connections between ducts of dissimilar metals and at penetrations of mechanical equipment room walls.
2. Install flexible connections with 2 inches slack in fabric and minimum movement of 1 inch.
3. For fans developing static pressures of 5-inch WG and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

D. Flexible Ducts
1. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
2. Connect diffusers or light troffer boots to ducts with maximum 18-inch lengths of flexible duct clamped or strapped in place.
3. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws. Attach to

supply air duct with low entrance lass, bellmouth type connector at air inlet end.

E. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

F. Install wire mesh screen grilles at return air ducts in hung ceilings and in other places where indicated. Bolt grilles to flanged connections or ducts at terminations.

G. Install louvers in building construction at locations where indicated. Coordinate mounting details with particular building construction and/or window framing details. Install blank-off panels at unused portions of louvers; secured with bolts and/or screws.

H. Air Flow Measuring Stations
   1. Install air flow measuring stations where indicated, or as directed by engineer.
   2. Install all interconnecting tubing between measuring station, companion meter and control systems, in accordance with the manufacturer's printed instructions.

I. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

J. Install fire dampers and combination fire and smoke dampers at required locations. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
   2. Install dampers square and free from racking with blades running horizontally.
   3. Do not compress or stretch damper frame into duct or opening.
   4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
   5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

K. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

L. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts and as indicated. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install volume dampers at the following locations:
      a. At all splits, except grease exhaust ducts.
      b. In ducts serving single supply, return and exhaust outlets.
      c. In open return ducts above ceiling.
      d. In ducts connecting to a common plenum.
      e. Where required for balancing.
   2. Install remote damper operators for volume dampers above ceilings which are non-accessible or without access panels.
   3. Install steel volume dampers in steel ducts.
   4. Install aluminum volume dampers in aluminum ducts.
   5. Do not install volume dampers in grease ducts.

END OF SECTION

SECTION 238000

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Air conditioning and air handling equipment including but not limited to:
   1. Single Packaged Air Conditioning Units, Heat Pump.

B. Related Requirements:
   1. Division 01: General Requirements.
   2. Section 07 6000: Flashing and Sheet Metal.
   3. Section 22 1000: Plumbing.
   4. Section 23 0500: Common Work Results for HVAC.

1.2 DESIGN REQUIREMENTS

A. Work of this Section is based on HVAC equipment units indicated as Basis of Design in Part 2 of this Section. Products from different HVAC equipment manufacturers listed are never identical, although equivalent in capacity, performance and quality. In the cases where dimensions, weight, configuration and utility requirements differ from the products used as a basis of design, the Contractor, at no additional cost to the Owner, shall coordinate and submit, for Architect review, revisions to the design.

1.3 SUBMITTALS

A. Provide in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

B. For products listed that are not the basis of design, submit the following in addition to above requirements:
   1. Title 24 Calculations: Replace HVAC unit values in calculation files provided by the Architect and submit for review.

1.4 QUALITY ASSURANCE

A. Provide submittals in accordance with Section 23 0500: Common Work Results for HVAC.

1.5 PROJECT RECORD DOCUMENTS

A. Provide Owner instructions on equipment operation and maintenance procedures, as indicated in Section 23 0500: Common Work Results for HVAC.

1.6 WARRANTY

A. Compressors shall be provided with manufacturer's five year warranty, replacement only.

B. Manufacturer shall warrant parts, except heat exchangers, for a period of five years.

C. Heat exchangers shall be provided with manufacturer's ten year warranty, replacement only.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Capacities of air conditioning equipment indicated on Drawings are net capacities actually required. Standard catalog ratings shall be adjusted to actual Project site environmental conditions.

2.2 AIR CONDITIONING UNITS - AC (2 Tons-25 Tons)

A. Manufacturers: Carrier, Trane, York, Lennox, American Standard Heating & Air Conditioning, or equal.

B. Basis of Design: [Trane] Furnish packaged air conditioning unit with gas heating for roof top installation. Unit shall be self-contained, completely factory assembled, with complete internal wiring and controls. Unit shall also be provided with a fully piped refrigerant circuit, fully charged with an environmentally friendly refrigerant that is not scheduled for phase out. Unit shall be field configurable for down-flow or horizontal discharge. Cooling and heating capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

C. Quality Assurance:
   1. Units shall be CSA certified for outdoor installation.
   2. Cooling capacity shall be rated in accordance with current ANSI/AHRI Standard 210/240.
   3. Unit shall be UL listed and designed to conform to ANSI/ASHRAE Standard 15 Safety Code for Mechanical Refrigeration and ANSI Z21.47-2016/CSA 2.3-2016 Gas
   4. ANSI/NFPA 70: National Electrical Code.
   5. Unit cooling efficiency EER/SEER ratings shall comply with CCR, Title 24, Building Energy Efficiency Standards for Residential and Nonresidential Buildings, and shall not be less than ratings indicated on drawings.
   6. Unit heating efficiencies AFUE ratings shall comply with current CCR, Title 24, Building Energy Efficiency Standards for Residential and Nonresidential Buildings, and shall not be less than ratings indicated on drawings.
   7. Unit shall comply with California Maximum Oxides of Nitrogen (NOX) Emission Regulations and current SCAQMD regulations.
   8. The unit roof curbs shall conform to NRCA standards.
   9. Insulation and adhesive shall meet NFPA 90A and 90B requirements for flame spread and smoke generation.
   10. Unit casing shall be capable of withstanding ASTM B117 500-hour salt spray test.
   11. Each unit shall be run tested at factory per ANSI/ASHRAE 37 and provided with a certificate indicating tested pressures, amperages, dates, and inspector.

D. Unit Cabinet:
   1. Galvanized steel with baked enamel finish on external surfaces that are exposed to weather.
   2. Interior surfaces exposed to conditioned and return air streams shall be insulated with a minimum ½-inch thick, 1 pound density foil-faced cleanable insulation.
   3. Cabinet top cover shall be of one piece construction or where seams exist, shall be double hemmed and gasket sealed.
   4. Cabinet panels shall be hinged access panels for filter, compressors, evaporator fan, control box and heat section areas. Each panel shall use multiple quarter-turn latches. Each major external hinged access panel shall be permanently attached to rooftop unit. Panels shall also include tiebacks.

5. Return air filters shall be accessible through a hinged access panel and be on a slide-out track using standard size filters.
6. Holes shall be provided in base rails (minimum 16 gage) for rigging shackles and level travel and movement during overhead rigging operations.
7. Unit shall have a factory-installed internally sloped condensate drain pan, providing a minimum ¾-inch-14 NPT connection to prevent standing water from accumulating. Pan shall be fabricated of high impact polycarbonate material, epoxy powder coated steel or stainless steel and shall slide out for cleaning or maintenance. An alternate vertical drain (¾-inch NPT) connection shall also be available. Drain pans shall conform to ASHRAE 62 self-draining provisions.

E. Compressors:
1. Unit shall be furnished with single (If single compressor is used, then it shall be Two Stage type) or multiple fully hermetic scroll compressors with internal vibration isolators.
2. Dual electrically and mechanically independent refrigerant circuits for 7.5 tons and above.
3. Compressors shall be provided with service access valves.
4. Compressor motors shall be cooled by refrigerant passing through motor windings.
5. Compressors shall be provided with line break thermal and current overload protection.
6. Compressors shall be provided with crankcase heaters, internal high-pressure and temperature protection.
7. Compressors on unit rated 90,000 BTU and below shall be of two stage types.

F. Refrigerant circuit components:
1. Thermostatic expansion valve (TXV) with removable power element.
2. Refrigerant strainer.
3. Service gage connections on suction, discharge, and liquid lines.
4. Solid core refrigerant filter driers.

G. Evaporator and Condenser Coils: Standard Evaporator and condenser coils shall be furnished with:
1. Acceptable Condenser Coils:
   a. Copper-tube, Aluminum-fin coil, with liquid subcooler. Internally enhanced OD seamless copper tubing mechanically bonded to aluminum fins in combination with a factory applied Corrosion-Resistant Epoxy Coating. Provide Protective Hail Guard.
   b. Spine Fin condenser coil shall be continuously wrapped, corrosion resistant aluminum with minimum brazed joints. This coil is 3/8 inch OD seamless aluminum tubing glued to a continuous aluminum fin. Coils are lab tested to withstand 2,000 pounds of pressure per square inch. The outdoor coil provides low airflow resistance and efficient heat transfer. The coil is protected on four sides by louvered panels.
   c. Coil shall be air-cooled Micro-Channel Heat Exchanger Technology (MCHX) and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a factory applied Corrosion-Resistant Epoxy Coating. Provide protective Hail Guard.
2. Evaporator coils
   a. Aluminum plate fins mechanically bonded to enhanced copper tubes with joints brazed.
   b. Tube sheet openings shall be belled to prevent tube wear.
   c. Evaporator coil shall be of full-face active design.
   d. Dual circuit models shall have face-split type evaporator coil.

H. Evaporator and Condenser Coils shall be furnished with copper plate fins mechanically bonded to enhanced copper tubes with copper tube sheets and brazed joints with a factory applied Corrosion-Resistant Epoxy Coating utilizing dipping process. Provide protective Hail Guard.

I. Fans and Motors:

1. Evaporator fan shall be a dynamically balanced, double width, double inlet, forward curved centrifugal type, fabricated of steel with a corrosion resistant finish that was tested and rated in accordance with AMCA requirements.
2. Evaporator fans shall be direct-driven for the AC Units with the cooling capacity of less than or equal to 48,000 BTU/H, and belt or direct-driven for the AC units with the cooling capacity of greater than 48,000 BTU/H, as indicated on Drawings.
3. Direct drive fans shall be provided with ECM motor.
4. Evaporator blower and motor shall have permanently lubricated, factory-sealed ball bearings and automatic-reset thermal overload protection.
5. Belt drive shall include an adjustable-pitch motor pulley. Belt drive fans shall accommodate from 0.6 inch to 1.6-inch external static pressure without changing drives or motors.
6. Condenser fan shall be a dynamically balanced, propeller type, fabricated of aluminum blades riveted to corrosion resistant steel spiders and direct-driven by a totally enclosed motor. Condenser air shall be discharged vertically. Condenser fan motor shall be high efficiency or ECM type motor and provide cooling operation down to 25 degrees F outdoor temperature with automatic-reset thermal overload protection.

J. Controls, Safeties and Diagnostic Points:
1. Unit Controls: Unit shall be furnished with self-contained, network capable and ready direct digital controls.
    a. Controls shall be factory-installed.
    b. Controls shall operate with zone control systems.
    c. Controls shall furnish built-in diagnostics for thermostat commands for staged heating and cooling, evaporator-fan operation, and economizer operation.
    d. Controls shall be furnished with a 5-minute time delay between modes of operation.
    e. Control circuit shall be protected by a fuse on 24-V transformer side.
    f. Control shall incorporate passive infrared detection for sensing occupancy in space serve.
2. Compressor high temperature, high current, internal overloads, internal thermostat.
    a. Compressor reverse rotation protection.
    b. Loss-of-charge/low-pressure switch.
    c. Freeze-protection thermostat, evaporator coil.
    d. High-pressure switch. The lockout protection shall be easily disconnected at control board, if necessary.
    e. Internal relief valve.
    f. Anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any off cycle.
3. Operating Characteristics:
    a. Unit shall be capable of starting and operating at 125 degrees F ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 360 at plus or minus 10 percent voltage.
    b. Compressor with standard controls shall be capable of operation down to 25 degrees F ambient outdoor temperature.
4. EMS Diagnostic Points: Provide diagnostic points for units, including those at projects with no EMS.
    a. Supply air temperature.
    b. Return air temperature.
    c. Space temperature.
    d. Outdoor air temperature.
    e. Filter status.
    f. Fan status.
    g. Compressor status.
    h. Economizer damper current position.
    i. Other diagnostic point required by current Title 24, automated fault detection and diagnostics (FDD).

K. Filter Section:
   1. Provide filter section with factory-installed low-velocity, throwaway 2-inch thick high capacity, MERV 8 Class 2, or equal, filters of commercially available sizes unless noted otherwise on the drawings.
   2. Filter face velocity shall not exceed 300 fpm at nominal airflows.
   3. Filter section shall allow installation of standard size air filter.
   4. Return air filters shall be accessible through a hinged access panel using standard size filters.

L. 100 Percent Outdoor Air Economizer:
   1. Provide 100 percent outdoor air economizers as indicated on drawings.
   2. Gear-driven integrated economizers.
   3. Integrated integral-modulating type capable of simultaneous economizer and compressor operation.
   4. Furnish hardware and controls to provide cooling with outdoor air.
   5. Low-leakage dampers not to exceed 3 percent leakage, at one inch wg pressure differential (variable sliding economizer).
   6. Barometric relief damper. Damper shall close upon unit shutoff.
   7. Differential temperature and enthalpy controller unless indicated otherwise on drawings.
   8. Provide units with centrifugal power exhaust controlled by a pressure sensor in space or outdoor air measurement and tracking as indicated on drawings. The controller shall modulate VFD in centrifugal power exhaust to maintain a pressure differential of 0.03 inch of water between indoor and atmospheric pressure. Furnish field wiring to power exhaust and install tubing in space. Provide other accessories as required to comply with UL or ETL requirements.
   9. Base Rail: Factory installed on both horizontal and down-flow units.
   10. Dampers Using Electronic Actuators:
      a. Manufacturer: Belimo, Honeywell, Invensys, Johnson Controls, or equal.
      b. Size for torque required for damper seal at load conditions.
      c. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
      d. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to prevent damage to the actuator during a stall condition.
      e. Fail-Safe Operation: Mechanical, spring-return mechanism.
      f. Power Requirements: Maximum of 10 VA at 24 VAC or 8 W at 24 VDC.
      g. Proportional Actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable by use of external computer software. Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload and mechanical travel. Programming shall be through EEPROM without the use of actuator mounted switches.
      h. Actuators shall be listed by ISO 9001, ULC, and CSA C22.2.

M. Furnish programmable digital thermostat with following features for single zone units that are not provided with variable volume and variable temperature type controls:
   1. 7-day time clock.
   2. Heat, cool, automatic changeover.
   3. Occupied/unoccupied modes.
   4. Dry contact switch for input from an external device such as a central time clock, occupancy sensor or a telephone activated device.
   5. Remote sensors. School Areas that could be subject to vandalism or accidental impact damage such as Gymnasiums, Auditoriums, Multipurpose Rooms, Corridors, and Lobbies shall be provided with thermostats with remote return air duct or room sensors. Verify remote location of sensors and thermostats with Architect.
   6. Robertshaw, Honeywell, Johnson Controls, Carrier, Schneider Electric, Viconics, or equal with built-in occupancy sensor. Refer to Section 23 0900 for areas with zone damper controls.

N. Demand Controlled Ventilation:

1. Units with 100 percent outdoor air economizers shall be provided with Indoor Air Quality (CO2) Sensor and Accessory Electronic Expansion Boards.
2. The unit shall have ability to provide demand ventilation indoor-air quality (IAQ) control through economizer when provided with an indoor air quality sensor and accessory expansion board.
3. The IAQ sensor shall be wall mounted unless otherwise indicated on Drawings. The set point shall be adjustable.
4. The IAQ sensor shall be powered through unit. If not, required control transformer shall be provided by manufacturer. Coordinate power requirements and location with Division 26.
5. The IAQ sensor shall provide a 0-10 VDC signal to expansion board.

O. Parts Availability: Submit proof in writing that majority (minimum 80 percent) of the replacements parts are commonly available and not proprietary. Also, submit proof in writing that a local parts sales and service facility exists, where replacement parts will be warehoused in quantity. Guarantee timely availability for parts that are proprietary.

2.3 FILTERS

A. Air filters shall be of pleated, high capacity, disposable type of efficiencies indicated on drawings. Each filter shall consist of a non-woven cotton fabric media, media support grid, and enclosing frame. Filter shall be UL 900 listed, Class 2.

B. Filter media shall provide an average efficiency as specified on drawings per ASHRAE Standard 52.2.

C. Initial resistance of air filters shall not exceed following limits for each efficiency level at face velocities indicated. Lower resistance requirements, if indicated on drawings shall have precedence.

30 percent (MERV 8)	0.27 inch water gage at 500 feet per minute
75 percent (MERV 11)	0.28 inch water gage at 500 feet per minute
85 percent (MERV 13)	0.30 inch water gage at 500 feet per minute
95 percent (MERV 14)	0.38 inch water gage at 500 feet per minute

D. Use standard size Filter Medias only.

E. Media support shall be a welded wire grid or a rigid frame with an effective open area of not less than 96 percent.
1. Media support shall be bonded to filter media to eliminate possibility of media oscillation and media pull-away.
2. Media support grid shall be formed in such a manner that it effectively forms a radial pleat design, providing total use of filter media.

F. Enclosing frame shall be bonded to air entering and air exit side of each pleat, to ensure pleat stability. Inside periphery of enclosing frame shall be bonded to filter pack, thus eliminating possibility of air bypass.

G. Holding frames shall be factory fabricated of 16 gage galvanized steel, or equivalent and shall be furnished with gaskets and spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without use of tools.

H. Manufacturers: Camfil Farr, Koch, or AAF.

2.4 LOUVERS, AIR CONDITIONING (use in conjunction with relief damper)

A. Standard steel louvers shall be furnished complete with frames, blades, finish and construction details per Drawings and manufacturer’s recommendations.

B. Louvers shall be furnished with horizontal blades, 2 inches deep for air through wall installation in conjunction with gravity relief damper for backdraft protection that will open at 0.01 inch wc room static pressure as indicated on Drawings. Blades shall be 16-gage steel, spaced at 1 7/8-inch at 30 degrees angle, and with baked epoxy coating. Panel size shall be as indicated but not less than 24 inches width by 18 inches in height.

PART 3 – EXECUTION

3.1 GENERAL

A. Examine areas under which Work of this Section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EQUIPMENT FOUNDATIONS

A. Provide foundations (housekeeping pads, level platforms or curbs) for mechanical equipment whether indicated on drawings or not. Equipment foundations shall be of sufficient size and weight, and of proper design to preclude shifting of equipment under operating conditions, or under abnormal conditions imposed upon equipment.

B. Provide foundations (housekeeping pads, level platforms or curbs) for mechanical equipment whether indicated on drawings or not. Foundations shall meet requirements of equipment manufacturer and, when required by Architect, obtain from equipment manufacturer, approval of foundation design and construction, for equipment to be installed. Equipment vibration shall be maintained within design limits and shall be dampened and isolated. Isolators shall be bolted to a structural member so as to be readily removable.

3.3 EQUIPMENT DESIGN AND INSTALLATION

A. Uniformity: Unless otherwise specified, equipment of same type or classification shall be product of same manufacturer.

B. Application: Only provide equipment as reviewed by Architect.

C. Equipment Installation: Equipment installation shall be in strict accordance with these Specifications, and installation instructions of manufacturers. Equipment installed on concrete foundations shall be grouted before piping is installed. Piping shall be installed in such a manner as not to place a strain on equipment. Flanged joints shall be adequately extended before installation. Piping shall be graded, anchored, guided and supported, without low pockets.
   1. Install equipment in a neat and skillful manner, properly aligned, leveled, and adjusted for satisfactory operation.
   2. Install so connecting and disconnecting of piping and accessories can be readily accomplished, parts are readily accessible for inspection, service and repair. Space shall be provided to readily remove filters, coils, compressors and fan wheels. Access doors shall be hinged with cam lock door handles.
   3. Provide flexible connections for duct, pipe and conduit connections at moving equipment.

3.4 NOISE AND VIBRATION

A. Operation of Equipment: Mechanical equipment and piping systems shall operate without exceeding specified noise and/or vibration levels.

B. Corrective Measures: If specified noise and/or vibration levels are exceeded, provide necessary changes to reduce noise and/or vibration levels to within specified levels.

3.5 FIELD TESTS AND INSPECTION

A. General: Perform field inspections, field tests, and trial operations as specified in Section 23 0500: Common Work Results for HVAC. Provide labor, equipment and incidentals required for testing. The Project Inspector will witness field tests and trial operations as specified in Section 23 0500: Common Work Results for HVAC.

B. Equipment and Material: Equipment and material certified as being successfully tested by manufacturer, in accordance with referenced Specifications and standards, will not require re-testing before installation. Equipment and materials not tested at place of manufacture will be tested before or after installation, as applicable or necessary, to determine compliance with reference Specifications and standards.

C. Start-Up and Operational Test: System shall be started up and initially operated with components operating. During this test, various strainers or filters shall be periodically cleaned until no further accumulation of foreign material occurs. Adjust safety and automatic control instruments as required to provide proper operation and control sequence. Refer to Section 23 0500: Common Work Results for HVAC.

D. Extent of Field Tests: After installation and before completion, Work of this Section shall be subjected to required field tests, including those specified here and in Section 23 0500: Common Work Results for HVAC.

E. Operation and Maintenance Data: Provide required operation and maintenance data as specified in Section 23 0500: Common Work Results for HVAC.

3.6 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

3.7 PROTECTION

A. Protect Work of this Section until Substantial Completion.

END OF SECTION

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.

B. Related Requirements:
1. Division 01 - General Requirements.
2. Section 03 3000 - Cast-in-Place Concrete.
3. Section 09 9000 - Painting and Coating.
4. Division 14 - Conveying Equipment.
5. Division 23 - HVAC.
6. Division 27 – Communications.
7. Division 28 - Electronic Safety and Security.

C. Applicable Standards
1. ASTM D 709 (2007) – Laminated Thermosetting materials.
2. ANSI/NEMA FB-1 (2010) – Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
3. ANSI/NEMA 250 (2008) – Enclosure for Electrical Equipment (1000 Volts Maximum).
4. California Electrical Code (CEC).
5. IEEE C57.12.28 (2005) – Standard for Pad-Mounted equipment (Enclosure Integrity).
6. UL 1 (2005) – Standard for Flexible Metal Conduit.
7. UL 1242 (2007) – Standard for Electrical Intermediate Metal Conduit.
8. UL 506 (2008) – Specialty Transformers.
9. UL 6 (2010) – Electrical Rigid Metal Conduit-Steel.
10. UL 797 (2007) – Electrical Metallic Tubing-Steel.
11. UL 870 (2008) – Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.2 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:
1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.
2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:
1. For purposes of clearness and legibility, Drawings are essentially diagrammatic, and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer’s data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
2. Verify final locations for rough ins with field measurements and with the requirements of the equipment to be connected.
3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.

4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.
6. Coordinate electrical equipment and materials installation with building components and the Work of other trades
7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
8. Coordinate connection of electrical systems with existing underground utilities and services.

C. Terminology:
1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.
2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.
3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:
1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906.3 for conduits and pipes embedded in concrete and Sections 2308.9.10 and 2308.9.11 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.
2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.
3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:
1. Furnished Equipment and Appliances:
   a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.
   b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.
2. Equipment and Appliances Furnished by Others:
   a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless

otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 23. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped, and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

I. WARRANTIES

1. Provide one-year warranty on all material and labor performed, unless noted otherwise in specific sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Advise the Inspector before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

3.2 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for Torrance Airport identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.3 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.4 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 260513

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Boxes, enclosures, keys and locks.
   2. Receptacles and switches.
   3. Identifications and signs.

B. Related Requirements:
   1. Division 01 - General Requirements.
   2. Division 26 – Electrical.
   3. Division 27 – Communications.
   4. Division 28 - Electronic Safety and Security.

PART 2 - PRODUCTS

2.1 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:
   1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.
   2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.
   3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.
   4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.
   5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2 1/8-inch deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with two ears drilled 2 23/32 inches center to center.
   6. For local device outlets provide 4-inch square 2 1/8-inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than two switches.
   7. For TV outlets, and horns and strobes provide manufacturer’s supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.
   8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.
   9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, single-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Raco, Appleton, Cooper, Bowers, or equal.
   10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.
   11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.
2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.
3. Covers shall be fastened to box with a sufficient number of machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.
4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:
    a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.
    b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.
    c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.
5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.
6. Underground Concrete Pull Boxes:
    a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet by 3 feet by 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inch by 10 inch in each 3 feet side, and one 20 inch by 20 inch knockout in each 2-foot side. Pull boxes with inside dimension 4 feet by 4 feet by 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8-inch by 16-inch on each of two opposite sides, and one 20-inch by 20-inch knockout on each of other two opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one inch diameter ground rod knockout. In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4 inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required. Pull boxes shall be as manufactured by Oldcastle Precast, Jensen Precast, Kistner, Western Precast, or equal.
    b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.
    c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
    d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.
    e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with CEC Article 250.
    f. Provide 6-inch deep sand base under pull boxes.
    g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.
    h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer's test results for Architect's review as part of materials and equipment submittals.
    i. The use of underground extension boxes shall be limited to not more than 1 times the original depth of pull box.

7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Oldcastle,Jensen, Kistner, Western Precast, or equal.
8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Floor Outlets:
1. Provided floor outlets, except for extension outlets, shall be Harvey Hubbell Inc. B-2503, Thomas & Betts 640 series, Legrand Omnibox, or equal, adjustable, cast iron, watertight floor boxes with flush brass floor plates, and shall be set to finish flush with finish floor covering, whether it be carpeted, wood, resilient floor covering, or other finish materials.
2. Telephones above floor outlets, where not subjected to water, shall be provided with Harvey Hubbell Inc. SC-3098 pedestals with SC309T plates, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections.
3. Plugs above floor outlets where not subjected to water shall be provided with Legrand 525 series, Thomas & Betts FPT-400 Series, Harvey Hubbell Inc. SC-3098, or equal, pedestal and with SS309D, or equal, device plates. Refer to other Division 26 sections.
4. Plugs above floor outlets where subjected to water shall be provided with a Harvey Hubbell Inc. SA-6685 or equal, single-gang outlet box, or SA-6687 or equal, 2-gang outlet box. Provide required cover plate. Refer to other Division 26 sections.
5. Furnished extension floor outlets shall be cast iron floor boxes with cast iron covers and 1/2 inch offset entries for above-floor conduit extensions; Harvey Hubbell F3186, or equal. Boxes shall be designed to permit access to wiring without disturbing above-floor extensions and shall be set flush with finish floor.
6. Furnished above floor service fittings for surge suppression receptacles shall be Hubbell SC3098 with cover plates SS309DS, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal.
7. Furnished above floor service fittings for data outlets shall be Hubbell SC3098 with required cover plates, Legrand 525 Series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections.

D. Floor Pockets:
1. Three-Gang: Furnished three-gang floor lighting pockets shall be flush floor type, with cast iron floor plate and hinged cast iron door notched for cables. Three-gang floor pockets shall be owner approved Legrand or Hubbell Recessed Floor Boxes, C.W. Cole TLS-353-6, or equal, for wood floors and C.W. Cole TLS-353-6-C, or equal, for concrete slabs. Each floor pocket shall be provided with three 20 amp, 3 wire, 125 volt receptacles with matching caps.
2. Single Gang:
   a. Receptacle floor pockets shall be single gang, flush floor type, with cast iron floor plate, hinged cast iron door notched for cable and cast iron box; C.W. Cole TLA-362-1-FE, or Owner approved Legrand or Hubbell recessed floor box or equal. Provide each pocket with a standard, single grounding type receptacle unless otherwise indicated. Provide C.W. Cole TLS-362-1, or equal.
   b. Microphone or projector floor pockets shall be single gang flush floor type with cast iron floor plate, hinged cast iron door, notched for cable and cast iron box, or owner approved Legrand or Hubbell recessed floor box, C.W. Cole TLA-362-3-FE, C.W. Cole TLS-362-3, or equal.

E. Keys and Locks:
1. Provide two keys with furnished door locks, including cabinet door locks and switchboard locks, two keys for lock switches on switchboards or control panels, and two keys with interlocks or other furnished lock switches. Deliver keys to OAR.
2. Locks shall be keyed to Corbin No. 60 keys for access to operate equipment and Corbin 70 keys for service access. Special keys and locks shall only be provided where specified.

2.2 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20	PS5362-I	HBL5362-I	5362-I
(15 amps) NEMA 5-15	PS5262-I	HBL5262-I	5262-I

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262BL (blue), Hubbell DRUBTVSS15, Leviton 5262-SBU, 15 amps, 120 volts, or equal.

3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361-I	HBL5361-I	5361-I
(15 amps) NEMA 5-15R	5261-I	HBL5261-I	5261-I

4. 15 and 20 amps single receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour NEMA 5-20R model number 5361-BL (blue), and NEMA 5-15R model number 5261-BL (blue) respectively. Equal receptacles by other Owner approved manufactures are acceptable.

5. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2010 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20R	2095-I	GFR5352-IA	7899-I
NEMA 5-15R	1595-I	GFR5252-IA	8598-I

6. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast lockable hinged lids and weatherproof mats.

7. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000 amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

NEMA #	Pass& Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5352BLSP	HBL5360SA	5380B
(15 amps) NEMA 5-15R	5252BLSP	HBL5260SA	5280B

8. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

B. Switches:

1. Local Switches:

a. Provide local switches, high strength thermoplastic toggle, specification industrial grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1I	HBL1221I	1221-2I
Double pole	PS20AC2I	HBL1222I	1222-2I
Three way	PS20AC3I	HBL1223I	1223-2I
Four way	PS20AC4I	HBL1224I	1224-2I

b. Provide lock type switches, specification industrial grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Key shall be Torrance Airport standardized vertically oriented, tamper resistant, forked key with two each 5/16-inch long forks, 5/32-inch spacing between forks and 5/16-inch width overall.

	Pass & Seymour	Arrow Hart
Single pole	PS20AC1L w/#500 Key-2L	1221L w/1201LK Key
Double pole	PS20AC2Lw/#500 Key	1222L w/1201LK Key
Three way	PS20AC3L w/#500 Key	1223L w/1201LK Key
Four Way	PS20AC4L w/#500 Key	1224L w/1201LK Key

c. Provide remote control switches for mechanically held contactors arranged for 3-wire control, toggle type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles

Pass & Seymour	Hubbell	Leviton
1251-I	HBL1557-I	1285-I

d. Provide remote control switches for magnetically held contactors arranged for 3-wire control, toggle type, maintained contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclosed mechanism, and ivory handles.

Pass and Seymour	Hubbell	Leviton
1225-I	HBL 1385	1285-I

e. Momentary Contact locking key type switch. 20A 120/277V center off. Key shall be Torrance Airport standardized vertically oriented, tamper resistant, forked key with two each 5/16” long forks, 5/32” spacing between forks and 5/16” width overall.

Arrow Hart
AH1995L w/ AH2000 key

f. Momentary Contact switch low voltage 1 pole 3A 24VAC 3 position center off. Key for locking switch shall be Torrance Airport standardized vertically oriented, tamper resistant, forked key with two each 5/16” long forks, 5/31” spacing between forks and 5/16” width overall.

Pass and Seymour
Toggle 1081I
Locking 1081KGRY w/#500 Key

2. Time Switches and Photoelectric Controls for existing construction; use section 26 0923 for new construction.
   a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switch-board. Contacts rated for 25 amps resistive or inductive, each pole 240 VAC; 5 amps tungsten or 277 VAC pilot duty, each pole 240 VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable super capacitor power carry-over system. Battery carryover is not acceptable. Provide a minimum of 15 on/off set points per week. Timing to be in one minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation. Time switches; Paragon Model

EC7000 Series, Tork Model EW 101B series, Intermatic ET7000 series, or equal. Features required for application:.

1) Liquid crystal display panel.
2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.
3) Automatically adjusts to and from daylight savings time and for leap year.
4) Contact ratings: 10 amp at 240 VAC.
5) Safety override switch for each circuit to either provide shut down of circuit or to override on.
6) Selective review: All or part of schedule shall be displayed at touch of a key.
7) Super Capacitor for power carry over system.
8) Supply voltage: 120 V.
9) 365-day advance scheduling.

b. Photoelectric control: Shall be rated 2,000 watts, 120V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2 inch conduit fitting, Tork series 2100, or equal.

3. Emergency Lighting Control Unit
   a. The Emergency Lighting control Unit shall provide all required functionality to allow an standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
   b. The emergency lighting control unit shall allow control of emergency lighting fixture in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.
   c. The device shall have normally closed dry contacts capable of switching 10 amp emergency ballast loads at 120-277 VAC, 60 Hz, or 2 amp tungsten loads at 120 VAC, 60Hz.
   d. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.
   e. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency)
   f. The device's normal power input terminal shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.
   g. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.
   h. Device shall be WattStopper ELCU-100 Emergency Lighting Control Unit, LVS #EPC-PM Series, Lighting Control Design #GR 2001 series or Equal.

2.3 IDENTIFICATION AND SIGNS

A. Identification Plates:
   1. Provide identification plates for the following unless otherwise specified, for switchboards, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.
   2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:
1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.
2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "WARNING-HIGH VOLTAGE- ABOVE 600 VOLTS". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

C. Warning Signs:
1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required reading, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2-inch high lettering.
2. Provide a warning sign on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required reading, "DO NOT OPEN UNDER LOAD". Provide 2 inch high lettering.
3. Provide signs of standard manufacture, 18 gage steel, with porcelain enamel finish. Provide red lettering on a white background.

PART 3 - EXECUTION

3.1 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated adjustable attachment bar hangers between studs to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 Tessco A1200HS-10, Cooper B-Line B22s-HG, or equal channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8 inch 16 threaded steel rod with a Unistrut P-4008, Fastenal #48604, Copper B-Line 78101140346 or equal nut and a Tomic No. 711-B Adapta-Stud, or equal. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2 inch locknut on stud and a 3/8 inch 16 hex nut locking stud to rod.

C. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:
1. Install wall-mounted telephones, light switches, and other switches, 48 inches above finished floor. Refer to other Division 26, 27 and 28 Sections.
2. Outlet boxes for fire alarm pull stations shall be mounted at 45 inches above finished floor to insure that the operating handle of the initiating device is no higher than 48 inches at finished floor. Under

no circumstances shall operating handle of the device exceed 48 inches above finished floor regardless of indicated height on drawing.

3. Wall mounted fire alarm strobe or horn/strobe devices shall be mounted such that the entire lens is not less than 80 inches above finished floor. If ceiling heights allow, wall mounted appliances shall have bottom of lens a minimum of 80 inches but not more than 96 inches to the top of lens.
4. Install outdoor fire alarm audible devices or fire alarm sprinkler flow bells at least 10 feet but not more than 12 feet above finished floor to center. Provide STI or equal protective covers for devices when required.
5. Voice evacuation speakers mounted indoors shall be mounted in ceiling space or if mounted on wall shall not be less than 10 feet to center above finished floor.
6. Install clocks and speakers, in offices, 8 feet above finished floor. Unless otherwise indicated.
7. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.
8. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.
9. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.
10. Install panelboards and terminal cabinets 6 feet 6 inches from finish floor to top of cabinet.
11. Install television outlets at a height corresponding to location of television monitor, or a minimum of 15 inches above finished floor.
12. The use of extension boxes shall be limited to not more than 1 times the original depth of junction box.

3.2 COVER PLATES

A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless-steel plates. Flush lighting outlets to be blanked shall be covered with Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:
   1. Three-gang and larger gang switches.
   2. Lock switches.
   3. Pilot switches.
   4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.
   5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etcetera.
   6. Receptacles operating at other than 120 V shall be identified with the operating voltage.
   7. Switches operating on 277 V shall be identified with the operating voltage.
   8. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

E. Standard GFI cover plates shall be Pass & Seymour 4600, Raco 5028-0, or equal. GFI cover plates shall be provided with a CAM lock mechanism with two keys or a padlock hasp that does not protrude through the face of the cover and will allow the shank of locks keyed Corbin No. 60 keys.

3.3 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points.

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.4 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.5 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 260516

MEDIUM-VOLTAGE CABLES, SPLICES AND TERMINATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Medium-voltage cables, splices and terminations.
   2. Single conductor 15,000 volt shielded copper power cable insulated with ozone and discharge resistant flexible, rubber like thermosetting dielectric for medium-voltage applications, suitable for use in wet and dry locations in conduit and underground ducts.

1.2 SUBMITTALS

A. Samples: Submit three 36 inches long pieces of the proposed cable.

B. Submit a complete material list.

C. Shop Drawings: Submit a layout drawing of the proposed installation.

D. A certified test report per The Association of Edison Illuminating Companies (AEIC) CS-8 from the factory shall be furnished to the Project Inspector, before installation, for each length of cable delivered to the Project site. This report shall certify that cable meets latest requirements of Insulated Cable Engineers Association (ICEA) and shall include all required test data. High voltage cable shall not be installed until cable and test report has been reviewed by the Architect. Submit eight copies of the report, of which two will be returned. Test shall be performed in accordance with (NETA Specification) ANSI/ICEA S-97-682, S-97-649 and UL Standard 1072; the test could be performed by a Nationally Recognized Testing Laboratory (NRTL) or approved equal.

1.3 QUALITY ASSURANCE

A. The cable manufacturer shall have a minimum of 15 years manufacturing EPR insulated cables.

B. Cables shall be tested for corona discharge and shall comply with AEIC requirements. A copy of the original x-y plot showing discharge levels shall be included as part of the certified test reports. Submit test report for Architect/Engineer review prior to installation.

1.4 WARRANTY

A. The manufacturer shall provide a five-year material warranty.

PART 2 - PRODUCTS

2.1 CABLE

A. Medium-voltage cable shall be furnished where line-to-line operating voltage exceeds 600 volts. Cable shall be 15 KV, single conductor, 133 percent insulation level, ethylene propylene rubber insulated, shielded, PVC jacket Type MV-105.

B. Conductors shall be Class B stranded annealed, uncoated copper.

C. Insulation system conductor screens, insulation and insulation screens shall be capable of continuous operation at conductor temperatures of 105 degrees C. and emergency overload temperatures of 140 degrees C.

D. Cables shall be identified indicating manufacturer, size, insulation type, voltage rating, year manufactured, and UL, or other Nationally Recognized Testing Laboratory designations.

2.2 STANDARDS

A. Cables shall conform to the following standards where applicable:
   1. Insulated Cable Engineers Association (ICEA).
   2. Institute of Electrical and Electronic Engineers (IEEE).
   3. California Electrical Code (CEC).
   4. Underwriters' Laboratories (UL).
   5. Association of Edison Illuminating Companies (AEIC).

B. Reels of furnished cable shall be newly manufactured of not more than 12 months old, and shall bear tags containing name of manufacturer, CEC designation, and year of manufacture.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION

A. Installation of cable, including joints, splices, taps, bends, connections, terminations, and method of pulling cable into conduit shall be performed in accordance with manufacturer's recommendations. Install splices, taps and terminations in a manner recommended by cable manufacturer. Stress cones shall be installed on cable at joints, splices, and terminations as recommended by manufacturer of cable. Minimum bending radius of cable shall be in strict accordance with recommendations of manufacturer. Certified Cable Splicer with minimum experience of five years required. Pulling compound shall be environmentally safe.

B. Cables shall be identified at points of termination and points where conduit run is broken, as to phase leg and feeder designation, with markers. This requirement applies at man-holes, switchboards, pull boxes, and like items. Markers shall be E-Z Code, Brady Perma-Code, or equal. ID tags shall be water proof and one inch in size.

C. After cable is installed and connected, but with all equipment disconnected from cable system, each cable shall be subjected to a high potential DC test in presence of the Inspector. Notify the Inspector not less than two working days in advance of proposed time for test. Hi-Pot test shall be NETA Acceptance Values.

D. Test shall be performed with equipment specifically designed for this type of test and in a manner recommended by cable manufacturer. Copies of test report shall be submitted to the Architect for review. Test voltage shall be raised gradually in steps to final voltage recommended by ICEA, which shall be applied for five minutes. Current readings shall be taken at each step after leakage current has stabilized and readings shall be plotted on graph paper. If breakdown is indicated during test by a

sudden increase in current, discontinue tests and provide required repairs and replacements necessary to correct defective Work.

E. Provide new cable to replace entire length of each cable run not meeting minimum requirements of test. Perform splices and terminations necessary for replacement of cable. Repair and/or replace splices and terminations test results indicate to be defective Work.

3.2 CABLE TERMINATIONS

A. Provide termination kits capable of proper termination of 15 KV class single conductor cables. Kits shall meet Class I requirements and be design proof tested in accordance with IEEE 48-2009. Kits shall accommodate common forms of cable shielding/construction without the need for special adapters or accessories and shall accommodate a range of cable sizes. Kits shall be capable of proper installation on out-of-round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available environmentally sealed connectors.

B. Terminations for single conductor shielded cables shall consist of heat shrinkable stress control and other required non-tracking insulation tubing or tapes. Kits shall also contain high relative permittivity stress relief mastic for insulation shield cutback treatment with a heat-activated sealant for environmental sealing.

C. Demonstrate actual field experience and suitable accelerated and real-time testing of weathering resistance. Test reports, which verify device stability with time, temperature, and electrical stress variations, shall be submitted for review.

3.3 CABLE SPLICES

A. Splices shall be factory engineered kits that rebuild the cable insulation to that of the cable. Splices shall contain necessary components to reinstate the cable's primary insulation, metallic shielding and grounding systems, and an outer jacket.

B. Splices shall be capable of passing the electrical test requirements of IEEE-404-2006 and water immersion tests of ANSI/IEEE 386-2006. (NETA Specification)

C. Splices shall be of uniform cross-section, heat shrinkable polymeric construction utilizing an impedance layer stress control tube and high dielectric strength insulating layers. Outer insulating layer shall be bonded to a conducting layer for shielding. The splice shall be re-jacketed with a heat shrinkable adhesive-lined sleeve to provide a waterproof seal, or factory approved taping kit such as Scotch 5717, or equal.

D. Splices shall accommodate a range of cable sizes and be completely independent of cable manufacturer tolerances. Splices shall be capable of being properly installed on out of round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available connectors.

E Splices, which consist of three or more cables, shall be performed with 600 AMP Elastamold T Bodies, Hubbell, Cooper or equal. The splice shall be capable of removing or adding a conductor and restoring the connection in an electrically safe and waterproof condition. Installation of 200 AMP T Bodies is not permitted.

3.4 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 260519

LOW-VOLTAGE WIRES (600 VOLT AC)

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.2 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 WIRES

A. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.

B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.2 STANDARDS

A. THWN/THHN wires shall comply with the following standards:
   1. UL 83 for thermoplastic insulated wires.
   2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed, and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values

C. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.

D. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

E. Pressure cable connectors, pre-insulated 3M Scotchlok, Hubbell Power, O-Z/Gedney or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except telephone systems.

F. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V, and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

G. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

I. Wire switchboards, panel cabinets, pull boxes, and other cabinets, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

J. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

K. Maintain the conductor required bending radius.

L. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

M. Fire alarm shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

N. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be

independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.
    a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).
    b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.
    c. Test reports shall include the following:
        1) Identification of the testing organization.
        2) Equipment identification.
        3) Ambient conditions.
        4) Identification of the testing technician.
        5) Summary of project.
        6) Description of equipment being tested.
        7) Description of tests.
        8) Test results.
        9) Analysis, interpretation and recommendations.
2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.
    a. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.
3. Tests shall be performed in the presence of the Project Inspector.
4. Insulation resistance shall not be less than 100 mega-ohms.

3.2 COLOR CODES

A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the Project Inspector. Except where otherwise specified, color-coding shall be as follows:

SYSTEM	COLOR CODE
Clocks	Pink, Gray and Orange

Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power (4 wire smoke detectors, duct detectors)	Brown (+) and White (-) Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)

3.3 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.4 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.6 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide and install grounding system as indicated or required.

B. Related Requirements:
1. Refer to related sections for their system grounding requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Division 27: Communications.

1.2 QUALITY ASSURANCE

A. Reference Standards:
1. IEEE 142 Green Book.
2. Underwriter's Laboratories (UL).
3. California Electrical Code.
4. Building Industry Consultant Services International (BICSI) (Signal).
5. EIA/TIA (Signal and power).
6. Nationally Recognized Testing Laboratory (NRTL) or equal.

1.3 SYSTEM DESCRIPTION

A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.

B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.

C. Metallic systems shall be effectively bonded to the main grounding electrode system.

D. A separately derived AC source shall be grounded to the equipment grounding conductor, and to separate “made” electrode of building grounding electrode system.

E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over six feet in length shall be provided with a green insulated grounding conductor of required size.

F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes due to the installation of insulating couplings and non-metallic pipe in such installations. In addition to bonding to cold water pipe provide at least one of the following made grounding electrodes:
1. A dedicated “made” electrode, fabricated of at least 20 feet of galvanized 1/2 inch diameter rebar encased by at least two inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 CAD welded bare copper cable, or be CAD welded directly to the bus. The CAD weld shall be at least four inches

above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.

2. Grounding electrodes as specified hereafter in this section.
3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least two inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors. An external electrode, as specified hereafter or as required by the CEC, shall be installed and connected to foundation or footing rebar.

G. Non-current carrying metal parts of high-voltage equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded. Provide a CEC sized grounding conductor in every raceway.

H. Metallic or semi-conducting shields and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.

I. Neutral of service conductors shall be grounded as follows:
1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.
2. Equipment and conduit grounding conductors shall be bonded to that grounding point.
3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.
4. Equipment grounding conductor is installed from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to “made” electrode for that building.
5. Feeder neutrals shall be bonded at service entrance point only; neutrals of separately derived systems shall be bonded at the source only.

J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to “made” electrode serving the building.

K. Within every building, the main switchboard or panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.4 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger, if necessary to obtain required clearances. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast-iron frames cast into boxes. Yard boxes shall be Jensen Precast, Oldcastle Precast, Western Precast, Kistner, or equal.

B. “Made” electrodes shall be copper-clad steel ground rods, minimum 3/4 inch diameter by ten feet long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be two inches above planting surfaces.

B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box..

C. Grounding rods shall be driven to a depth of not less than eight feet. Permanent ground enhancement material, (GEM) as manufactured by Erico Electrical Products, Loresco Powerset, Tessco Ultrafil or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.

D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.

E. When installing grounding rods, if resistance to ground exceeds 25 ohms, two or more rods connected in parallel, or coupled together shall be provided to meet grounding resistance requirements.

F. Ground rods shall be separated from one another by not less than ten feet.

G. Parallel grounding rods shall be connected together with recognized fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.2 TESTING

A. Provide the services of an approved independent testing laboratory to test grounding resistance of “made” electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:
   1. Visually and mechanically examine ground system connections for completeness and adequacy.
   2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.
   3. Perform the two-point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.
   4. Test shall be performed in the presence of the Inspector.

B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.4 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 260533

RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raceways and wire ways.
   2. Conduit installation.
   3. Underground requirements.

B. Related Requirements:
   1. Section 26 0500: Common Work Results for Electrical.
   2. Section 26 0513: Basic Electrical Materials and Methods.
   3. Division 27: Communications.
   4. Division 28 - Electronic Safety and Security.

C. Applicable Standards and Codes.
   1. EIA/TIA 569 Standards.
   2. National American Standards Institute (ANSI).
   3. National Electrical Manufacturer’s Association (NEMA).
   4. Nationally Recognized Testing Laboratory (NRTL).
   5. California Electrical Code (CEC).
   6. Uniform Building Code (UBC).
   7. Underwriters Laboratory (UL).

1.2 SUBMITTALS

A. Materials List: Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Conduit Materials:
   1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each ten-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.
   2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, conduits, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.
   3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.
    a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.
5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.
6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.
7. Multi-cell raceway shall be four inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or Torrance Airport approved equal.
8. Metal Clad (MC) cable system is not allowed.

B. Sleeves for Conduits: Sleeves shall be adjustable type by Carlon, U.S. Plastic, PEP Plastic or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, equivalent Cooper Crouse Hinds Thru-Wall, Legrand Thru-Wall, or equal.

D. Expansion Joints-Seismic Separations between building(s) and other locations as indicated on drawings:
1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, Cooper XJGD or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z/Gedney type EX, Cooper XJGD, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture’s internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.
2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts, Crouse-Hinds or approved equal.

E. Conduit Seal Fittings:
1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Thomas & Betts EYS, Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Thomas & Betts EYD, Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with CEC.
2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Surface Steel Raceway:
1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Mono-Systems, Inc. or equal. The raceway system may be supplied pre-wired in accordance with all sections of these specifications and requirements herein and shall be UL or another NRTL listed. Computer data installation shall be as required by other sections of this Division.
    a. If furnished pre-wired, the system must be listed in accordance with UL or another NRTL for “Multiple Outlet Assemblies” and so labeled on interior of the assembly. The pre-wired

installation must contain no extra wire splices in the raceway as compared to a contractor assembled installation assembled from components. The pre-wired steel raceway shall be Hi-Pot tested at the factory to prevent any potential bare wire or shot circuit defects.

2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.
3. The raceway shall be a two-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system, Hubbell HBL750 series and Mono-Systems Inc. S145-700 series that shall be a one-piece design. The base and cover sections shall be a minimum of 0.040-inch wall thickness. The base section shall be available in ten-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500, Hubbell V500, and Mono Systems inc. SM500 series are not permitted.
4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.
5. Device brackets shall be furnished for mounting single or two-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.
6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate installation. Computer data installation shall be as required by other sections of this Division.
7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

G. Factory Pre-Wired Surface Metal Raceway:
1. Furnish and install pre-wired surface metal raceways as indicated on Drawings and as specified.
2. Metal Raceway shall be galvanized steel Wiremold V4000, Hubbell 4000 series, or Mono-Systems Inc. SMS-4000 series complete with raceway base, cover, fittings, receptacles and mounting plates required for a complete assembly. Raceway shall have two wiring compartments with integral dividing barrier for isolating the wiring compartments.
3. Pre-wired assembly shall be UL, or another NRTL listed as a multi-outlet assembly and surface raceway as labeled on interior of assembly.
4. Wiring devices and other components shall be factory installed, electrically wired and covers labeled as indicated on drawings. Each receptacle shall be identified with panelboard and circuit number from which it was fed. Grounding shall be maintained by means of factory installed grounding conductors.
5. Where shown on Drawings, Raceway covers shall have provisions for mounting computer data outlets.
6. Complete assembly is to consist of required fittings such as elbows, slide couplings for joining raceway sections, blank end caps and flat tees.
7. Prewired assembly must contain no wire splices.
8. Receptacles and wiring shall be as indicated on drawings and as specified.
9. Where raceway is used for power and computer data outlets, installation of data outlets shall be as required by other sections of this specification.
10. Prior and during installation, verify and comply with manufacturer's installation instructions.
11. Entire assembly shall be tested for shorts, opens, ground faults, and wire insulation at factory and certified. Raceways shall be electrically continuous and bonded in accordance with California Electrical Code.
12. Submit shop drawings for approval showing the complete layout of all components of each raceway, raceway lengths, each component description, location and circuit identification.
13. All wiring devices shall be removable without requiring disassembly of wireway.
14. Standard non-OEM wiring devices shall be used as specified in Torrance Airport specifications.

H. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed and shall be Square D Type LDB NEMA-1 enclosure for interior applications, or Type RDB NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.

I. Penetration in Fire-Rated Structures: Provide 3M, or equal, sealant and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator hoistways. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

J. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. General Requirements:
1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.
2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.
3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall be installed:
    a. For continuous lengths not exceeding more than 50 feet between pull points (pull boxes, outlet boxes, etcetera).
    b. With no maximum total raceway length located within a building interior when the flex is located in concealed locations.
4. Flexible Steel conduit shall not exceed 1-1/2 inches in size.
5. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.
6. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.
7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one-hole pipe strap.
8. If connection is from a flush wall-mounted junction box, install an approved extension box.
9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.
10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.
11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not

less than ten times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least six inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.
13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. Crouse Hinds XJGD, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, Crouse Hinds XJGD, or equal. Provide Crouse Hinds, Thomas & Betts, or O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.
14. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:
    a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered two inches from rear of cabinet.
    b. Conduits entering back of cabinet shall be aligned in a single row centered two inches from top of cabinet.
    c. Conduits shall not be spaced closer than three inches on centers.
15. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps. Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.
16. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.
17. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or two-inch x four-inch headers fitted between joists or wall studs.
18. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.
19. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.
20. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for two-inch conduit hangers and smaller and shall be 1/2 inch for 2 ½-inch conduit hangers and larger.
21. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, equivalent Cooper B-Line or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124, equivalent Cooper B-Line, or equal. Conduits shall not be stacked one on top of another, but a maximum of two tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.
22. Conduits suspended on rods more than two feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.

23. Factory fabricated pipe straps shall be one or two-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.
24. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.
25. Conduits shall be supported at intervals required by code, but not to exceed ten feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape are not permitted for the support of conduits.
26. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.
27. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.
28. Flex conduits shall be cut square and not at an angle.
29. Routing of conduits may be changed providing length of any conduit run is not increased more than ten percent of the length indicated on Drawings.

B. Underground Requirements:
1. Conduits and multicell raceways installed underground shall be entirely encased in three inch thick concrete on all sides, except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.
2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.
3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid tight. Bends at risers shall be completely below surface where possible.
4. Conduits and raceways in a common trench shall be separated by at least three inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of six inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.
5. The Inspector will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the Inspector before and after placing concrete. Mandrel shall be six inches in length minimum and have a diameter that is within 1/4 inches of diameter of conduit to be tested.
6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1 ½-inch inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic conduit for public telephone system shall be not less than ten times trade size of conduit, unless otherwise specifically permitted.
7. Furnish and install a six-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".
8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.
9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.
10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a four-inch galvanized nipple with ground bushing.

11. Underground conduit for systems operating above 600 volts shall be a minimum size of four inches.
12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.
13. Underground conduits and raceways shall be swabbed prior to wire pull.

C. Rooftop conduit shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Blok, or equal. Roller type supports shall be provided below and above conduit to prevent its dislodgement. Bottom of conduits shall clear the roof surface by 10 inches.
   1. At PVC roofing provide walk tread, polyester reinforced, UV resistant, with surface embossment at rooftop supports. Heat welding of walk pads shall only be done by manufacturer certified installers.
      a. Sika-Sarnafil and Carlisle: Walk tread shall be no more than one inch larger than the plan area of the pipe support blocks and adhered to the roof membrane with Sika 1A or Carlisle Universal Single-Ply sealant, as applicable.
      b. Johns Manville: Walk tread shall be installed under the pipe support blocks and adhered to the blocks, if possible, and left loose laid on top of the PVC roof system. Walk-pad shall have a minimum of 4 inches of material past perimeter on all 4 sides of block.
   2. Built-up roofing: Provide APP granulated modified torch-down at each pipe support block. Torch-down shall extend 2 to 4 inches beyond the edges of the block and adhered by torch application over existing cap sheet membrane. This work shall be performed by a certified roofer.

D. General Installation Requirements for Computer Network System Conduits:
   1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.
   2. The maximum pulling tensions of the specified cables shall not be exceeded, and proper radius of cable bends shall be maintained.
   3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than six feet.
   4. Interior section of conduit run shall be no longer than 100 feet and shall not contain more than two bends of 90 degrees between pull points or pull boxes.
   5. The inside radius of a conduit bend shall be at least six times the internal diameter of the conduit. When the conduit size is greater than two inches, the inside radius shall be at least ten times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least ten times the internal diameter of the conduit.
   6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.
   7. Splicing or terminating cables in pull boxes is not permitted.
   8. For indoor application, a pull box shall be provided in conduit run where:
      a. The length is over 100 feet.
      b. There are more than two bends of 90 degrees.
      c. There is a reverse bend in the run.
   9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.
   10. Where a pull box is provided with raceways, pull box shall comply with the following:
      a. For straight pull-through, provide a length of at least eight times the trade-size diameter of the largest raceway.
      b. For angle and U-pulls:
         1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least six times the trade-size diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.
         2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
            a) Six times the trade-size diameter of the raceway; or

b) Six times the trade-size diameter of the larger raceway if they are of different size.

c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus six times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed and furnish and install required fittings.

E. Slabs on Grade:

1. Unless specifically reviewed by the Architect, conduits 1 ¼-inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at bottom where conduits occur to provide three inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.
2. If concrete slab is five inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

F. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, seal with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07 9200: Joint Sealants.

3.2 STUBS

A. Panelboard: Install two one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend five feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the Inspector before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.
2. Over ends of individual underground conduit stubs or groups of conduit stubs, install four-inch by 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and two inches above finished grade in planting areas. Cast a three-inch by three-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.4 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 260923

LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Low-voltage lighting control system.

B. Related Requirements:
   1. Division 01 - General Requirements.
   2. Section 26 0500: Common Work Results for Electrical.
   3. Section 26 0513: Basic Electrical Materials and Methods.
   4. Section 26 0519: Low-Voltage Wires (600 Volt AC).
   5. Section 26 0533: Raceways, Boxes, Fittings, and Supports.
   6. Section 26 2416: Panelboards and Signal Terminal Cabinets.
   7. Section 26 5000: Lighting.

1.2 SUBMITTALS

A. Provide in accordance with Division 01.

B. Submit a complete one-line diagram of the proposed system configuration for Architect/Engineer's review. The riser diagram shall identify but not be limited to wiring, equipment, components, interconnection with other systems, and location and type of raceways.

C. Manufacturer's Data: Submit catalog cuts and description of each system component.

D. Provide wiring diagrams and installation details for lighting control equipment.

E. Shop Drawings: Submit a complete set of detailed Shop Drawings for the entire lighting control system; the shop drawings shall include but not be limited to relay panels with designations and dimensions, day light sensors locations based on manufacturer's recommendations, and system components with manufacturer's part numbers.

F. Installation Instructions: Submit manufacturer's written installation instructions, wiring diagrams. Instructions shall include recommendations for handling of equipment and parts, and protection and storage requirements.

1.3 QUALITY ASSURANCE

A. Components shall be listed and labeled by Underwriter's Laboratories (UL), or another Nationally Recognized Testing Laboratory (NRTL).

B. Lighting Control Systems shall comply with the state of California Building and Electrical Codes, and Title 24 energy requirements in effect at time of submittal for building permit.

C. Conduct a coordination meeting with the lighting control contractor, electrical contractor, EOR, Manufacturer Representative, and the OAR to validate the location of lighting control system

components, including daylight sensors. Sensors shall be located based on manufacturer's recommendations.

1.4 WARRANTY

A. Manufacturer shall provide a three year material warranty.

B. Installer shall provide a two year installation warranty.

1.5 SYSTEM REQUIREMENTS

A. Systems shall be furnished with networkable relay panels complete with relays, transformers, and control electronics. The system shall be furnished with hardware and resident software, occupancy sensors, constant light controllers, exterior light sensors, occupancy sensors, local wall switches and dimmer switches, conduit and wiring for a complete and functional installation.

B. The lighting control system must be able to communicate with fully digital centralized relay panels, remote relay panels, digital switches, photocells, analog switches, various interfaces, and shall include operational software. The lighting control system shall be integrated into a single system, except for areas controlled by a motion sensor; such as rooms with one luminaire and emergency fixtures designed to operate 24 hours a day, seven days a week. Distributed lighting control shall be provided using a networkable remote relay panel. A Centralized relay panel shall control corridors and site lighting. Lighting control system shall include hardware and software; software shall be resident within the lighting control system. System shall provide local access to programming functions at the master Lighting Control Panel (LCP) and remote access to programming functions via dial-up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have a server built into the master LCP that "serves" HTML pages to any authorized workstation. WEB front end shall be accessible over a Torrance Airport provided Ethernet 10/100 Mpbs to the local area network. Protocol shall be TCP/IP and allow either http (hypertext transfer protocol) or https (hypertext transfer protocol secured) connections. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital, non-server capable systems are not acceptable.

C. System software shall provide real time status of each relay, each zone and each group.

D. Lighting control system shall be able to be monitored and take commands from a remote Personal Computer (PC); should the remote PC go off-line system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an online PC or server for normal operation are not acceptable

E. Devices shall be able to be pre-addressed at the factory. Systems requiring field addressing only are not acceptable.

F. Programs, schedules, time of day, etcetera, shall be held in non-volatile memory at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.

G. System shall be capable of flashing lighting OFF/ON for any relay or lighting zone prior to the lights beings turned OFF. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled OFF sweep using local lighting zone override switches within the zone or occupied space. Occupant override time shall be pre-programmed not to exceed two hours, or current California Title 24 requirements.

H. The system shall be capable of implementing ON, OFF, Raise (dimming), and Lower (dimming) commands for any relay, group or zone by means of digital specification grade line voltage type wall switches, analog low voltage switches, photocells, web based software, or other devices connected to programmable inputs in the lighting control system.

I. The lighting control system shall provide the ability to control each relay and each relay group. Programming and scheduling shall be able to be done locally at the master LCP and remotely via dial up modem and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.

J. System may consist of centralized relay panels, remote relay panels, digital switches, analog switches, photocells, motion sensors, lumen control devices, dimmer switches, and various digital interfaces. Remote relay panels, smart breaker panels, centralized relay panels and digital switches shall communicate as one network. Remote Relay Panels (RRP) shall control lighting fixtures in that area or space, provide power to occupancy sensors and take input from daylight and occupancy sensors. RRP's shall be capable of taking inputs from Torrance Airport specification line voltage type switches, and if classroom dimming is indicated on the plans, they shall be capable of outputting an independent 0v to 10v dimming signal for each remote relay provided. Remote relay panels, switches, photocells and occupancy sensors shall be wired per lighting control manufacturers instructions.

1.6 LIGHTING CONTROL OVERVIEW-BY AREA CONTROLLED

A. Corridors and Open Areas:
   1. Corridors and other common areas are to be controlled by a combination of programmable low voltage keyed switches and time schedules supplied by the networked lighting control system.
      a. Low voltage keyed switches are operable 24 hours a day and are to manually switch lights ON and OFF.
      b. The central timer is to automatically sweep lights OFF after hours and provide scheduling capability.
      c. Interior corridors require occupancy sensors.

B. Custodial and Equipment Rooms:
   1. Custodial, Equipment rooms and unsupervised rooms shall be provided with occupancy sensors with automatic on-off capability in addition to manual switches. These sensors shall turn off the lights in the room via a pre-set but programmable interval after the room has been vacated.

C. Exterior Security Lights:
   1. Exterior wall packs and security lights are to be controlled via exterior light sensors.
      a. When natural light level is insufficient, the lights are ON.
      b. When natural light level is sufficient, the lights are OFF.

D. Exterior, Non-Security Lights:
   1. Exterior parking lot lights, pathway lights and decorative lights are controlled by an exterior light sensor in conjunction with time schedules provided by the networked lighting control system.
      a. When natural light level is insufficient or the timer is ON, the lights are ON.
      b. When natural light level is sufficient or the timer is OFF, the lights are OFF.

E. Restrooms:
   1. Restrooms Lights and Exhaust Fans (Fans interlocked with lights):
      a. Restrooms lights and fan shall be controlled from the lighting control panel via assigned relays. Provide ceiling mounted occupancy sensors, and by-pass toggle switches for system override adjacent to the door. The sensor shall turn off the lights in the room via a pre-set but programmable interval after the room has been vacated.

F. Emergency Lighting:

1. Emergency lighting controls shall be equipped with bypass circuitry that will bypass all manually operated switches, lighting control systems, dimmers and occupancy sensors during power failure situations. Design shall comply with applicable codes and regulations. Each area of luminaries or groups of luminaries shall be equipped with and controlled by a UL924 listed emergency lighting control unit to allow the detection of localized power failure.

PART 2 - PRODUCTS

2.1 RELAYS

A. Relays shall be warranted for a minimum of three years.

B. Relays shall be individually added or replaced. Lighting control systems incapable of replacing individual relays are not acceptable.

C. Each lighting control relay shall be capable of controlling incandescent, fluorescent, electronic ballast and HID lighting loads. Relays not rated for all types of lighting loads are not acceptable.

D. Relays shall be:
   1. Single Pole: Douglass WR-6161, LC&D SL-277-NC, or equal.
   2. Double Pole: Douglass WR-6172, LC&D SL-480-NC, or equal.

2.2 INTERIOR DAYLIGHT SENSORS

A. In rooms requiring day lighting control provide an interior daylight sensor. Refer to lighting plans to determine which switch legs are controlled by the daylight controller. Use LC&D iPC Series, Douglas WPH-3711, or equal.

B. Interior daylight sensors shall cause light fixtures within the room to brighten or dim to maintain pre-determined and uniform light levels between 30 and 50 foot candles; in areas not provided with dimming ballasts the sensors shall permit any relay to switch at a unique light level and shall attempt to maintain a constant light level by switching individual relays ON or OFF as the ambient light level changes. Controllers offering single set point controls are not acceptable.

C. Each interior daylight sensor shall continuously monitor the true light label and shall broadcast this level to lighting control network. Controllers requiring readings at the sensor head itself are not acceptable.

D. Each interior daylight sensor shall be fully adjustable via the lighting control software. Controllers requiring adjustments at the sensor head are not acceptable.

2.3 EXTERIOR LIGHT SENSORS

A. Provide one exterior rated light sensor for control of exterior lights. Use Douglass WPH-3751, LC&D PCO or equal.

B. One exterior light sensor shall permit different relays to switch at different light levels. Sensors offering less than 14 remotely settable trip points are note acceptable.

C. Exterior light sensor shall continuously monitor the true light level and shall broadcast this level over the lighting control network. Sensors requiring adjustments at the sensor head are not acceptable.

D. Exterior light sensor shall be fully adjustable via the networked lighting control system. Controllers requiring adjustments at the sensor head are not acceptable.

2.4 OCCUPANCY SENSORS

A. Occupancy Sensors:
   1. Ceiling-Mounted Dual Technology Sensors:
      a. Sensors shall be dual technology infrared-ultrasonic capable of detecting presence in floor area to be controlled, by detecting Doppler shifts in transmitted ultrasound and infrared technology.
      b. Detection shall be maintained when a person moves only within a maximum distance of 12 inches, in either a horizontal or vertical manner, at approximate speed of 12 inches per second. Lights shall not go off when a person is reading or writing while seated at a desk.
      c. Each sensor shall be furnished with a convenient shunt provision, which will enable a person to by-pass sensor in event of failure.
      d. Sensitivity shall not change more than ten percent in temperature range of 0 degrees F. to 120 degrees F., and in humidity range of ten percent to 80 percent. Sensitivity adjustment shall be provided for each technology.
      e. Time delay range shall be adjustable from 15 seconds to 15 minutes.
      f. Sensors shall operate on DC power (12 volts to 24 volts). Power supply shall be provided by power pack, consisting of a transformer and contact closure relay in one package. Power output of transformer shall be capable of operating a minimum of two sensors.
      g. Manufacturers: Watt Stopper No. DT-200, similar as manufactured by Leviton, Sensor Switch, Unenco, or equal.
   2. Passive Infrared Wall Switch Sensors with Daylight Controls:
      a. Sensors shall be capable of detecting presence in floor area to be controlled, by detecting changes in infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk.
      b. Passive infrared sensor shall utilize a dual-element sensor and a multi-element fresnel lens.
      c. Sensor shall be furnished with a daylight filter which ensures that sensor is insensitive to short-wavelength infrared waves, such as those emitted by the sun.
      d. Sensors shall be furnished with convenient bypass provisions, which enable lighting to be turned on in case of failure.
      e. Time delay range shall be adjustable from 15 seconds to 15 minutes.
      f. Sensitivity adjustment shall range from 0 (off) to ten (maximum).
      g. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering with adjustments and hardware.
      h. Each sensor shall cover up to 800 square feet, with a field-of-view of 150 degrees.
      i. Sensor shall be two-wire, completely self-contained control system that replaces standard toggle switch. Power supply shall be an internal transformer and switching mechanism shall be a latching dry contact relay.
      j. Sensor shall be capable of switching from 50 to 1000 watt, incandescent or fluorescent.
      k. Sensor shall be furnished with a daylight feature, adjustable from ten to 400 foot-candles, that maintains lighting off when a desired foot-candle level is present.
      l. Sensors shall be dual voltage, 120 volt and 277 volts.
      m. Manufacturers: Watt Stopper No. WI 200, I 300, similar as manufactured by Leviton Sensor Switch, Unenco, or equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Lighting control system shall not be used for ay other purpose other than its intended use and application.

B. Provide required interconnections with other systems such as emergency power sources, fire alarm systems, as required or indicated on drawings.

C. Installation shall meet or exceed standard practice of workmanship and quality.

D. Drawings generally indicate work to be provided, but do not indicate bends, transitions, or special fittings required to clear beams, girders or other work already in place. Investigate conditions where conduits are to be installed and furnished and install required fittings.

3.2 INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's drawings for location of line and low-voltage areas.

B. Provide Digital type switches, and wire according to lighting control manufactures requirements.

C. Digital switches and wire shall be according to lighting control manufactures requirements.

D. Panels shall be located so that they are readily accessible and not exposed to physical damage.

E. Panel locations shall be furnished with sufficient working space around panels to comply with the California Electrical Code.

F. Panels shall be securely fastened to the mounting surface by at least four points.

G. Unused openings in the cabinet shall be effectively closed.

H. Cabinets shall be grounded in accordance with Article 250 of the California Electrical Code, and manufacturer’s recommendations.

I. Lugs shall be suitable and listed for installation with the conductor being connected.

J. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

K. Maintain the required bending radius of conductors inside cabinets.

L. Clean cabinets of foreign material such as cement, plaster and paint.

M. Distribute and arrange conductors neatly in the wiring gutters.

N. Follow the manufacturer's torque values to tighten lugs.

O. Before energizing the panelboard, the following steps shall be taken:
   1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
   2. Remove shipping blocks from component devices and the panel interior.
   3. Remove debris from panelboard interior.

P. Follow manufacturers’ instructions for installation.

3.3 OPERATING/SERVICE MANUALS

A. Service and Operation Manuals:
   1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.
   2. Provide a printed copy of the systems configuration as programmed, including system labeling codes, and passwords.
   3. Provide an electronic copy on compact disk of the system configuration program.
   4. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.
   5. Record Drawings: Provide a copy on vellum of Project site and building drawings, indicating location of equipment, conduit and cable runs, and other pertinent information.

3.4 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.5 TESTING

A. Set-up, commissioning and testing of the lighting control system, and Owner instruction shall include:
   1. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.
   2. Operation of system's features under normal and emergency operations.
   3. Before energizing check and demonstrate in the presence of the Project Inspector that cables and wire connections are free from short circuits, ground faults, and that there is continuity, and necessary insulation.
   4. Confirm system operations and functionality.
   5. Check system interface response to other systems such as fire alarm power system conditions.
   6. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

3.6 INSTRUCTION PERIODS

A. Before Substantial Completion, arrange and provide an eight hours Owner instruction period for designated personnel.

3.7 SPARE PARTS

A. Provide a minimum of five percent spare parts of each type of relay, sensors, switches, and peripheral devices.

3.8 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 262416

PANELBOARDS AND SIGNAL TERMINAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Lighting and power distribution facilities, including panelboards.

B. Related Requirements:
1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 2600: Power Distribution Units.
5. Section 26 5000: Lighting.
6. Division 27: Communications.
7. Division 28: Electronic Safety and Security.

1.2 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included.

C. Installation Instructions: Submit manufacturer's written installation instructions.

1.3 DESIGN REQUIREMENTS

A. Panelboards:
1. Panelboards shall be wall-mounted, enclosed safety type with 120/240 volt, three-wire solid neutral 277/480 volt, four-wire or 120/208 volt, four-wire solid neutral mains as indicated on Drawings or specified. First panelboard of each building shall be provided with main or sub-feeder circuit breakers where so indicated.
2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.
3. Two- and three-pole branches shall be enclosed and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.
4. Main and subfeeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break mechanism, corrosion-resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall be furnished with interchangeable trip units. Handles

of main and subfeeder circuit breakers shall be provided cabinet door. Voltage rating shall be as indicated on Drawings.

5. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings. Series rated circuit breaker combinations are not acceptable.
6. Internal connections shall be fabricated with plated copper bus bars and the busses shall extend for full length of space available for branch circuit breakers. Feeder cable connectors shall be installed at point of feeder entrance. Terminals shall be furnished with copper conductors. Panelboards fed by conductors having over-current protection greater than 200 amperes shall be protected on supply side by over-current devices having a rating not greater than that of panelboards. Copper bussing shall be fully rated. Heat rated bussing is not acceptable.
7. Except where otherwise indicated, circuit breakers shall be in two vertical rows connected to bus bars in a distributed phase arrangement. Two-pole branches shall be balanced on busses. Single pole branches shall be numbered adjacent to its circuit breaker, with odd numbers on left and even numbers on right.
8. Specified circuit breaker spaces shall be furnished with hardware required for future installation of circuit breakers.
9. Provide locking devices for individual circuit breakers. Padlocking devices shall be secured to circuit breakers and by panel dead front plates.

B. Surge Suppressors: Where indicated on Drawings, provide transient voltage surge suppressors as an integral part of panelboards. Panelboards shall be complete with 200 percent rated copper neutral bus, ground bus and isolated ground bus in addition to requirements of this section. Surge suppressors shall be as follows:

1. Surge Capacity:
   a. Line-to-neutral for wye systems: 80 KA.
   b. Line-to-ground: 80 KA.
   c. Neutral-to-ground: 80 KA, three-phase wye.
   d. Line-to-neutral plus line-to-ground: 160 KA.
2. UL 1449 2nd Edition Suppressed Voltage Rating for 208/120 Wye System:
   a. Line-to-neutral: 400 volts.
   b. Line-to-ground: 400 volts.
   c. Neutral-to-ground: 400 volts.
   d. Maximum continuous over-voltage: 150 volts.
3. EMI/RFI High-Frequency Noise Power Filter (Characteristics):
   a. 100 KHz at 444 dB.
   b. 100 MHz at 44 dB.
   c. 10 MHz at 44 dB.
   d. 100 MHz at 444 dB.
4. MOVs shall be thermally protected for low current faults and shall be fused with surge-rated fuses. The surge-rated surge current passes and clears the circuit safely if the surge capacity is exceeded. Enhanced diagnostics shall continuously monitor the unit's status and shall include LEDs to signal a reduction in surge capacity or the loss of a suppression circuit. An audible alarm, with test and silence features, shall be furnished in diagnostic package.
5. Each phase or the entire unit shall be replaceable and have bolted-on, tin-plated copper connections. Unit to have UL witnessed fault current rating of 65,000 symmetrical amperes.
6. Surge suppression units shall comply with the following:
   a. UL certified.
   b. UL 1283.
   c. UL 1449.
   d. IEEE C 62.45.
   e. IEEE C 62.41.
   f. Nationally Recognized Testing Laboratory (NRTL) or equal.

C. Panelboard Cabinets:

1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gage furniture steel. Cabinets shall be furnished with at least six-inch high gutters at top and bottom where feeder cable size exceeds four gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than six inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than four inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.
2. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys.
3. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of contactor and other devices intact. Gutters shall be provided at sides and top of compartment. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 60 keys.
4. Provide and install panelboard manufacturer's permanent circuit number kit option.
5. Panelboards with control devices in compartment shall arrive at the Project site completely assembled with control devices installed and wired.
6. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, three point latching, vault type door handles with padlocking provisions. Provide stainless steel or galvanized butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 60 keys.
7. Self-tapping screws and bolts not permitted.

D. Panelboard Schedule: Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic 1/32 inch thick on inside of each panelboard cabinet door.

E. Panelboard nameplate: Provide a nameplate identifying panelboard. Plates shall be black and white plastic nameplate stock, with character cut through black exposing white and shall bare designation of service. Name plate shall be mechanically fastened to switchboard.

F. Provide additional labeling on dead-front of panelboard. Label shall be a P-Touch or equal with a minimum width of 3/8 inch with black letters on white background. Label shall re-identify panelboard and also identify name and location of power source feeding this panel. Location information shall include building name if located in different building and name or room location. If power source is installed in same room, label should indicate source name and "In this Room"

G. Panelboard Standards: Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:
1. California Electric Code, Article 384.
2. UL 67, Panelboards.
3. UL 50, Cabinets and Boxes.
4. UL 943, GFCI.
5. UL 489, Molded Case Circuit Breakers.
6. NEMA PB1.
7. Federal Specifications W-P- 115C and WC-375B.

H. Signal Terminal Cabinets:
1. Signal terminal cabinets shall conform to the Specifications for panelboard cabinets, except as modified herein.

2. Terminal cabinets shall be flush type, with two-inch trim or surface mounted type, as indicated on Drawings. Terminal cabinets shall be furnished with sections and barriers to separate each system. Sections over 24 inches in width shall be provided with double doors and locks. Terminal cabinets, or sections of terminals housing separate systems, shall measure 12 inches long by 18 inches high by 5 ¾-inch deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.
3. Terminal cabinets shall be furnished with ¾ inch thick plywood. Plywood shall be fastened in place with machine screws or factory installed mounting screws.
4. Flush-mounted terminal cabinets shall be finished as specified for flush-mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface-mounted panelboard cabinets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards shall be manufactured by Siemens, W.A. Benjamin, General Electric, Cutler Hammer, Square D or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Panelboards shall be located so they are readily accessible and not exposed to physical damage.

B. Panelboards installed outdoors shall be specifically listed for wet locations and shall be weatherproof in NEMA Type 3R cabinets.

C. Panelboard locations shall provide sufficient working space around panels to comply with the California Electrical Code.

D. Panelboards shall be securely fastened to structure and mounted on surface by at least four points.

E. Unused openings in cabinets shall be effectively closed as required by the manufacturer.

F. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

H. Lugs shall be suitable and listed for installation with the conductor being connected.

I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

J. Maintain the required bending radius of conductors inside the cabinet.

K. Clean the cabinet of foreign material such as cement, plaster, and paint.

L. Distribute and arrange conductors neatly in the wiring gutters.

M. Use the manufacturer's torque values to tighten lugs.

N. Before energizing panelboards, the following steps shall be taken:
   1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.
   2. Remove shipping blocks from component devices and panelboard interiors.
   3. Manually exercise circuit breakers to verify they operate freely.
   4. Remove debris from panelboard interior.

O. Follow manufacturer's instructions for installation.

P. Do not install in highly corrosive environments, unless rated for the application.

3.2 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.3 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 265010

SOLID STATE (LED) LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: LED Luminaires, LED modules, drivers, wiring, and lighting controls.

B. Related Requirements:
1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 0526: Grounding and Bonding.
5. Section 26 0519: Low-Voltage Wires (<600 Volt AC).
6. Section 26 0923: Lighting Controls Systems.
7. Section 26 5200: - Emergency Power Systems.
8. Section 32 1313 - Site Concrete Work.

1.2 REFERENCES

A. American National Standards Institute/American National Standard Lighting Group ANSI/ANSLG – C78.377-2008 Specifications for the Chromaticity of Solid-State Lighting Products.

B. American National Standards Institute/American National Standard Lighting Group ANSI/ANSLG – C82.77-2002 Harmonics Emission Limits.

C. Federal Communication Commission (FCC) 47 CFR Part 15 – Radio Frequency Devices.

D. Illuminating Engineering Society of North America (IESNA) LM-79-, LM-80-15, and TM-21.

E. National Electrical Manufacturers Association (NEMA) SSL-1-2010 Electronic Drivers for LED Devices, Arrays, or Systems.

F. SSL-3-2010 Solid State Lighting High Power LED Binning for General Illumination.

G. SSL-4-2012 Solid State Lighting Retrofit Lamps.

H. National Fire Protection Association (NFPA) NEC-70-2011

I. Underwriters Laboratories (UL) 8750-Light Emitting Diode (LED) Equipment for Use in Lighting Products.

J. Underwriters Laboratories (UL) 1598C- Light Emitting Diode (LED) Retrofit Luminaire Conversion Kits.

1.3 SUBMITTALS

A. List of Materials: Submit a complete list of proposed materials.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of

lamps, and complete details of method of fitting suspension and fastening luminaires in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Prior to start of construction; provide photometric calculations with graphic of lighting foot-candle levels at work plane, ceiling and walls. Calculations shall comply with IESNA recommendations.

D. Installation Instructions: Submit manufacturer's written installation instructions for luminaires and accessories.

1.4 SUBSTITUTIONS

A. Luminaires that deviate from these requirements shall not be accepted without written approval from OWNER'S Design Standards Section and Maintenance and Operations Technical Unit. When deviating or substituting luminaires, the following information shall be submitted:
   1. Substitution request form substantiating reasons and benefits to OWNER.
   2. OWNER'S approval shall be obtained for any equipment or materials substitutions. Proposed substitutions requests shall provide proof of compliance with OWNER'S LED Luminaires Evaluation Requirements found at the following electronic address:

B. Substitutions: Submittals must comply with contract general provisions.

1.5 QUALITY ASSURANCE

A. Design of lighting luminaires, accessories, supports, and method of luminaire installation shall comply with requirements for earthquake-resistant construction of the State of California.

B. Provide suspension points at no more than two feet from luminaire ends. Spacing between supports shall not exceed eight feet.

C. Components and luminaires shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL), and in compliance with applicable industry standards and codes, including those mentioned under article 1.02 – References.

1.6 WARRANTEE

A. Provide a one-year labor warranty.

B. Provide material warranty as specified:
   1. LED modules: five years minimum.
   2. Drivers: five years minimum.
   3. Lighting Pole (Standards): five year minimum.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

D. CONTRACTOR shall warranty Luminaires, including drivers, LED modules and ancillary components via a single warranty source. Multiple warranty sources are not acceptable.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Lighting luminaires shall be the type indicated on Drawings and as specified. Luminaires of same type shall be of one manufacturer.

B. Specific manufacturer and model number references are indicated as a standard of performance and quality; other manufacturers' models may be submitted for review, provided the product meets or exceeds the specifications and substantially complies with OWNER'S LED Luminaires Evaluation Requirements Form.

C. Conductors that pass over edges or through metal opening(s) shall be secured from contacting the edges or be protected from cutting and abrasion. This requirement shall be met through one of the following:
   1. Rolling the edge of the metal not less than 120 degrees.
   2. A bushing or grommet of a material other than rubber at least 1.2 mm (0.047") thick.
   3. Glass sleeving at least 0.025 mm (0.010") thick.

D. Lighting luminaires shall meet the following requirements:
   1. Industry standards as indicated under REFERENCES Article.
   2. Luminaire shall be from a manufacturer who has been in the business of manufacturing LED lighting luminaires for interior and exterior applications for a minimum of 5 years.
   3. Luminaires shall comply with the California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act, or be in compliance with the European Restriction of Hazardous Substances (RoHS), whichever is more stringent.
   4. Luminaires shall be baked-on enamel or powder-coated, unless otherwise specified in this section.
   5. The luminaire(s) lens, including end caps shall be 0.187 nominal thickness.
   6. Drivers shall be easily accessible without the use of special tools.
   7. Wiring cavity shall be field accessible for service or repairs.
   8. Luminaires shall be capable of being operated by standard motion/ vacancy sensors, daylight sensors, and dimmers.
   9. Luminaires shall be provided with a manufacturer's stencil or permanent legible sticker that states manufacturer business information and date of delivery.
   10. Temperature rating; -20 degrees Celsius minimum starting temperature. Luminaire accessories including LEDs and drivers shall be able to withstand temperatures in excess of 110 Fahrenheit degrees.
   11. Color Rendering Index (CRI):
      a. Interior Applications: +82 CRI.
      b. Exterior Applications: +70 CRI
   12. Power factor: Greater than 0.9 at 120V and 277V.
   13. Total Harmonic Distortion: Less than 20% at 120V and 277V.
   14. Color Correlated Temperature: 4000K minimum ± 275K degrees.
   15. LEDs and driver's life expectancy: 50,000 minimum projected hours at 6,000 hours testing for both LEDs and drivers.
   16. Luminaires in contact with insulation materials shall be IC rated.

2.2 DRIVERS AND LED MODULES

A. Drivers:
   1. Approved Drivers Manufacturers:
      a. Osram – Optotronic.
      b. Philips – Advance and Xitanium.
      c. Universal Lighting Technologies – Everline.
      d. General Electric – Lightech.
      e. Thomas Research Products
      f. Kenall – Low Profile LED Driver

g. EldoLED
h. Others only if approved by Torrance Airport M&O Technical Services and Design Standards units.

2. Driver Type and Characteristics:
   a. Comply with the state of California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act, or be RoHS compliant, whichever is more stringent.
   b. Dimming for 0-10 volt DC control circuits. Drivers shall be specifically compatible with the lighting control system being provided.
   c. Comply with applicable state, federal, and industry standards listed under References article.
   d. Wattage as stated in Luminaire's LM-79 test report.
   e. Driver performance requirements:

DRIVERS PERFORMANCE CHARACTERISTICS

No.	Characteristic	Minimum Requirements
1	Input Voltage range	120V, 277V
2	Input Overvoltage	320 VAC for 48 hours, 350 VAC for 2 hours.
3	Frequency	50/60 Hz Nominal
4	Power factor	0.95 Minimum
5	Inrush Current	Less than 30 amps @ 120V, Less than 70A @ 277V
6	Input Current Range	54A @ 120V, 23A @ 277V
7	Output Current	1670 mA Maximum
8	Maximum Power	65 Watts
9	Total Harmonic Distortion	Less than 20%
10	Leakage Current	Less than 500 mA
11	Output Protection	Short and Open Circuit Protection
12	Maximum Case Temperature	90^0 C
13	Minimum Starting Temperature	-20^0 C
14	Storage Temperature	No less than 70^0 C
15	Humidity	Rated for dry and damp locations
16	Cooling	Convection
17	Sound Rating	Class A
18	Life Expectancy	>50,000 hours at $+50^0$ C
19	Dimming, Motion Sensors and Daylight Sensors Controllability	0-10V

B. LEDs:
1. Approved Manufacturers:
a. General Electric.
b. Philips.
c. NICHIA
d. Samsung LED Co.
e. CREE
2. LEDs Characteristics:
a. Color Correlated Temperature (CCT):
1) Chromaticity target Duv and tolerance 0.001 plus/minus 0.006.
2) Nominal CCT for 4000K, target CCT 3985K ± 275K.
3) CCT measurements in compliance with ANSI C78.377-2008.
b. Lumen Maintenance: Greater than 90% at 500 C degrees.
c. LEDs must be from same manufacturer and batch.
d. TM-21 and LM-80 reported hours of no less than 50,000.
e. LM-79 reported CCT and CRI in compliance with articles 2.09.D.9 and 12.

2.3 LUMINAIRES (For exact make and model refer to lighting fixture schedule on electrical plans)

A. Lighting Luminaire Types:
1. Ceiling Surface-mounted or Recessed Troffer Luminaires:
a. 22 gage extruded aluminum doorframes, white baked enamel finish. Spring loaded and half recessed with flush latches and T-handle hinge, accessible from bottom to drivers and wiring. Clear prismatic 100 percent pure virgin acrylic Pattern 12.
b. Recessed Troffer Housing minimum depth shall be 4 ½-inch to eliminate lamp images in lens.
c. Minimum lens thickness 0.187 inch.
d. Furnish mounting frames on recessed luminaires in plaster and tile surfaces.
e. Manufacturers and catalog numbers: Modify catalog numbers for mounting in gypsum drywall ceilings, as required.
2. Surface-Mounted Industrial Luminaires:
a. Approximately 48-inch or 96-inch long by 16-inch wide by 7 ½-inch deep.
b. Provide couplings, clips and end caps for continuous row installation.
c. Furnish luminaires with screw-on wire guards. Design guards to accommodate luminaire, provided by same manufacturer as luminaire.
d. Exposed LED strips are not allowed.
e. Housing shall be made of die formed 20 gage cold rolled steel.
3. Surface Mounted Strip Light:
a. Luminaire shall be made of 20 gage die formed steel and have the ability for continuous row mounting.
b. Furnish luminaires with LED strips as indicated on drawings. Luminaire shall have the option to have narrow or wider housing channels depending on the application.
4. Enclosed and Vandal Resistant Luminaires:
a. Luminaire shall be 20 gage extruded aluminum with die cast end caps.
b. Luminaire shall have opal polycarbonate lens.
c. Furnish luminaires with LED strips as indicated on drawings. Luminaire shall have tamper resistant hardware.
d. Luminaire shall have the ability to be in continuous rows with seamless appearance.
e. Luminaire shall be listed for wet location.
5. Enclosed, Gasketed Luminaire:
a. Luminaire shall be 20 gage steel.
b. Lens enclosure shall be heavy duty vapor tight enclosed gasketed with closed–cell foam gasketing permanently attached to luminaire housing.
c. Luminaire shall have tamperproof latches.

d. Luminaire shall be furnished with minimum one watertight hub kit for top or end conduit entry.
e. Luminaire shall have option for cable mount and safety strap
f. Wet Location listed.

6. Surface, Wall or Recess Mounted fixtures
   a. Luminaire shall be 20 gage extruded aluminum with die cast end caps.
   b. Opal polycarbonate lens.
   c. Furnish luminaires with LED strips as indicated on drawings.
   d. Luminaire mounting as indicated on drawings.
   e. Luminaire shall be listed for damp and wet location.
7. Down Lights:
   a. 4 to 6 inch round LED downlight.
   b. Color trim as specified in construction drawings.
   c. Trim attachment to frame-in kit via push-in connector on frame.
   d. Removable cover for access.
   e. Complete luminaire including all peripheral devices including frame-in kit, light engine, trim kit, etc. shall be provided.
8. High Abuse Surface Luminaires:
   a. Lens shall be extruded polycarbonate, clear prismatic refractor, nominal thickness 0.125 inch, UV stabilized.
   b. Baseplate shall be 18 gage prime cold-rolled steel with corrosion-resistant, 92 percent reflective, white polymer finish.
   c. End caps shall be 16 gage prime cold roll steel with corrosion-resistant, white polymer finish and shall be spot welded to the baseplate.
   d. Lens/housing shall be furnished with a minimum of two large or four small stainless steel fasteners to secure lens/housing to base plate.
   e. Listed for wet and damp locations.
9. Wall Mounted Vaportite Luminaire:
   a. Luminaire housing shall be die cast aluminum with corrosion resistant polyester powder coated finish.
   b. Luminaire shall be heat and shock resistant, with prismatic glass optical chamber with neoprene gasketing.
   c. Luminaire shall be 15 or 20 watt LED; LEDs and drivers as indicated on drawings.
   d. Luminaire shall be equipped with lens guard.
10. Ceiling-Mounted Luminaires:
   a. Separate ceiling and reflector pans with foil-backed fiberglass between pans and 1/8 inch thick neoprene gasketing between ceiling pan and ceiling.
   b. White polyester finished 18 gage cold-rolled steel back-plate with clear prismatic injection molded polycarbonate lens, UV stabilized heavy gage aluminum back-plate and four tamper-proof screws.
   c. Provide luminaire wattage as indicated on drawings.
   d. Luminaire shall be listed for damp locations.
11. Ceiling / Wall Mounted Luminaires:
   a. Luminaire shall be die-cast aluminum.
   b. Luminaire shall have reinforced four-point mounting system construction to resist breakage from impact and prying.
   c. Luminaire finish shall be as indicated on drawings.
   d. Lens shall be Injection molded UV stabilized, high impact resistant opal polycarbonate.
   e. Luminaire shall have option trim ring to fit between housing and inside lip of trim ring for a smooth transitional look.
   f. Provide luminaire with input watts as indicated on drawings.
   g. Ceiling luminaires shall be supplied without eye lid option, wall mounted luminaires shall be supplied with eye lid option.
12. Outdoor Wall-Mounted Luminaires (Vandal Resistant):
   a. Seamless, one-piece, injection molded polycarbonate lens/housing, 0.187 inch, UV stabilized polycarbonate lens. The wraparound lens design encloses and protects the interior of unit.

b. Die cast aluminum mounting plate.
c. One-piece, full size, closed cell neoprene rubber gasket.
d. One stainless steel tamper-proof screw.
e. Luminaire shall be UL listed for wet locations.
f. Luminaires shall be provided with input watts as indicated on drawings.

13. Wall Mounted Full Cutoff Exterior Wall.
    a. Luminaire shall be mounted at no less than nine feet above finished grade, or as indicated in drawings.
    b. Housing shall be made of 20 gage die cast aluminum, and be equipped with hinged doors.
    c. Luminaire shall have Stainless steel tamperproof hardware.
    d. Luminaire shall be provided with input watts as indicated on drawings. Luminaire Optics shall be full 90 degree horizontal cutoff on all distributions. Reflector shall be specular aluminum. Luminaire shall have tempered glass lens with optional wire guard.
14. Wall-Mounted Luminaires (Vandal Resistant):
    a. One-piece prismatic refractor held by cast metal door, hinged to die-cast anodized aluminum weatherproof housing with visor to limit light pollution.
    b. Die-cast aluminum housing of 1/8 inch minimum wall thickness. Luminaire shall be provided with tamper-proof screws.
    c. High impact resistant, UV stabilized injection molded polycarbonate lense.
    d. High power LEDs.

2.4 EXIT ILLUMINATION

A. Lighting Luminaire:
1. Ceiling or wall-mounted, vandal-resistant type, LED EXIT, consisting of:
    a. LED board, green exit lettering and directional arrows as indicated on drawings.
    b. Face plate and polycarbonate shield.
    c. Number of faces, voltage, and emergency power source shall conform to design requirements indicated on drawings.
    d. Area of refuge listing is required when luminaires are used in such locations.
    e. Utilize a flag mount luminary with additional support from the ceiling or wall for canopy or pendant mounted exit signs. This option shall be exercised only if a wall is not available.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install a lighting luminaire for each lighting outlet indicated and label with day of installation.

B. Luminaire voltage shall be as indicated on Drawings.

C. Install recessed and surface-mounted luminaires, with plaster frames compatible with ceiling and wall systems employed; secure luminaires mechanically to frames.

D. Align rows of suspended and surface-mounted luminaires to form straight lines at uniform elevations.

E. Recessed luminaires shall fit snugly against ceilings to prevent light leakage.

F. Luminaire installations shall comply with CBC Seismic requirements

G. Support suspended recessed luminaires in T-bar ceilings as follows: Luminaires shall be attached to ceiling grid to resist a horizontal force equal to weight of luminaires. For heavy-duty grid systems, luminaires weighing less than 56 pounds must also have two 12 gage slack safety wires from diagonal

corners to the structure above; luminaires weighing more than 56 pounds shall be independently supported by not less than four taut 12 gage wires capable of supporting four times the load. For intermediate duty grid systems, luminaires shall be independently supported by not less than four taut 12 gage wires capable of supporting four times the load. Luminaire hanger wire ends shall be twisted three tight turns within a 1 ½ -inch distance. Provide positive point of attachment to T-bar ceiling with four, #8 wafer head tek screws (one at each corner), avoiding conflict with operation of the lens. Luminaire installation shall be coordinated with acoustical ceiling installation.

H. Emergency light luminaires shall be labeled “Emergency Luminaire” with one inch high letters produced with a P-touch or similar labeling system.

I. Continuous suspended luminaires:
   1. Luminaire suspension device shall allow vertical adjustment of luminaire without the use of tools. Cable shall be minimum seven strand twisted stainless steel capable of supporting minimum four times the luminaire weight. For continuous linear suspended luminaires longer than eight feet, provide not less than three suspension points.
   2. Top of luminaire shall be suspended as shown on the Drawings, typically 24 inches below the ceiling and a minimum of 18 inches from the ceiling.
   3. Luminaire shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.
   4. White Board Lights shall be suspended 24 inches from the wall unless specifically shown otherwise.

J. Surface mount luminaires shall be attached to structure. Toggle bolts are NOT permitted. Provide backing where required.

K. Low level exit signs shall be installed with the bottom of the sign not less than six inches, or more than eight inches above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign within four inches of the door frame.

3.2 TESTING

A. Check and adjust luminaires for required illumination.

B. Replace defective LED strips and drivers.

C. Test and adjust lighting control equipment for proper operation.

3.3 SPARE PARTS

A. Furnish ten percent spare LED strips with a minimum of one spare strip of each type.

B. Furnish ten percent spare motion detectors of each type with a minimum of one spare detector of each type.

C. Furnish ten percent spare drivers of each type with a minimum one spare driver of each type.

3.4 HAZARDOUS WASTE DISPOSAL

A. Hazardous waste disposals shall be handled and disposed of by an approved, licensed contractor.

B. Products with PCBs are not acceptable. Hazardous waste shall be placed in appropriate containers provided by hazardous waste contractor labeled clearly with:
   1. Project Name
   2. Quantity of materials
   3. Date materials became waste

C. Store, remove, transport and dispose of hazardous materials in accordance with state and federal regulations.

D. Provide Owner with copy of manifest and certificate of destruction.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.6 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean luminaire surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

END OF SECTION

SECTION 283100

FIRE DETECTION AND ALARM SYSTEM

ENGINEERING SPECIFICATION
INTELLIGENT REPORTING FIRE & GAS DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 13800 - Building Automation and Control.

B. Section 13900 (21 00 00) - Fire Suppression.

C. Section (27 15 00) - (Fire Alarm Communications Horizontal Cabling).

1.2 DESCRIPTION:

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

E. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 VOICE PANEL DESCRIPTION:

A. The voice evacuation panel shall comply with NFPA 72, Chapter 24 requirements.

B. The Voice Evacuation Control Panel shall be UL 864 listed (Fire Protective Signaling), UL 2572 listed (Mass Notification), ULC listed and Compliant with Unified Facilities Criteria UFC 4-021-01.

C. The installing company shall employ factory certified NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.4 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.5 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire and gas detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (3) years Rates and costs shall be valid for the period of five (3) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (3) years after expiration of the guaranty.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 72	National Fire Alarm Code
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems

No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and / or approval from the following nationally recognized or regional agencies:

UL	Underwriters Laboratories, Inc
ULC	Underwriters Laboratories Canada
FM	Factory Mutual
NYFD	New York Fire Department
CSFM	California State Fire Marshal

B. The system shall be approved for use in Marine applications by the following agencies.
1. United States Coast Guard
2. Lloyd's Register
3. American Bureau of Shipping The system shall be listed by the national agencies as suitable for extinguishing release applications. The system shall support release of low-pressure CO2.

C. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). The basis for qualification of seismic approval shall be via shake table testing.

PART 2 - PRODUCTS

2.1 Main Fire Alarm Control Panel or Network Node

A. Main FACP or network node shall be a NOTIFIER Model NFS-320SYS and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. Each network node shall provide or be capable of 318 intelligent / addressable devices per SLC loop.

C. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.

D. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire and gas detection system.

E. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

F. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

G. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.

H. The FACP or each network node shall provide the following features:
   1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   2. Detector sensitivity test, meeting requirements of NFPA 72.
   3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   4. Up to nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors, 0.5 to 2.5 percent per foot for ionization detectors, 0.5 to 4.0 percent per foot for acclimate detectors and 1.0 to 4.0 percent per foot for multicriteria (IntelliQuad and IntelliQuad PLUS) detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
   5. The ability to display or print system reports.
   6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

I. PAS presignal, meeting NFPA 72 requirements.
   1. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
   2. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
   3. Control-by-time for non-fire operations, with holiday schedules.
   4. Day / night automatic adjustment of detector sensitivity.
   5. Device blink control for sleeping areas.

J. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

K. For flexibility and to ensure program validity, an optional Windows (TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.
   1. This utility shall provide the ability to create and print NFPA style Test and Inspection reports
   2. This utility shall provide the ability to create and print Device Maintenance information

L. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

M. Each FACP or FACP network node shall support one SLC. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric, multi-criteria, thermal, laser, fire/CO) and 159 intelligent modules (monitor, control, relay, releasing) for a loop capacity of 318 devices. SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

N. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

2.3 Serial Interfaces

A. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

B. EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.

C. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.

D. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

2.4 Specific System Operations

A. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

B. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

C. Point Disable: Any addressable device may be enabled or disabled through the system keypad.

D. Point Read: The system shall be able to display or print the following point status diagnostic functions:
   1. Device status
   2. Device type
   3. Custom device label
   4. View analog detector values
   5. Device zone assignments

E. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be

stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

F. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

G. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

H. Software Zones: The FACP shall support 142 independent programmable software zones.

I. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

J. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

K. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
   1. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
   2. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
   3. All devices tested in walk test shall be recorded in the history buffer.

2.5 Communicators:

A. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

B. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.

C. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

D. Communication shall include vital system status such as:
   1. Independent Zone (Alarm, trouble, non-alarm, supervisory)
   2. Independent Addressable Device Status
   3. AC (Mains) Power Loss

4. Low Battery and Earth Fault
5. System Off Normal
6. 12 and 24 Hour Test Signal
7. Abnormal Test Signal (per UL requirements)
8. EIA-485 Communications Failure
9. Phone Line Failure

E. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

F. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.

G. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.

H. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

2.6 Gateway & Webserver Options

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.7 System Components & Addressable Devices

A. General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
14. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. The key used to reset the pull station must be the same as the key used to lock and unlock the FACP door(s).

15. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
16. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

B. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-951 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

C. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST-951 series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

D. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-951R.

E. IntelliQuad™ Advanced Multi-Criteria Intelligent Detector
1. Intelligent multi-criteria fire detector shall be a NOTIFIER model number FPTI-951. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible ad-

dresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.
    c. 3.5" (8.89 cm) octagonal box.
    d. Single-gang box.
10. Meets Agency Standards
    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

F. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.

G. Two Wire Detector Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1.
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA.

H. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

I. Addressable Releasing Control Module
1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12-volt solenoids.

J. Addressable Relay Module:
1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

K. Addressable Two-In / Two-Out Monitor/Relay Module:
1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

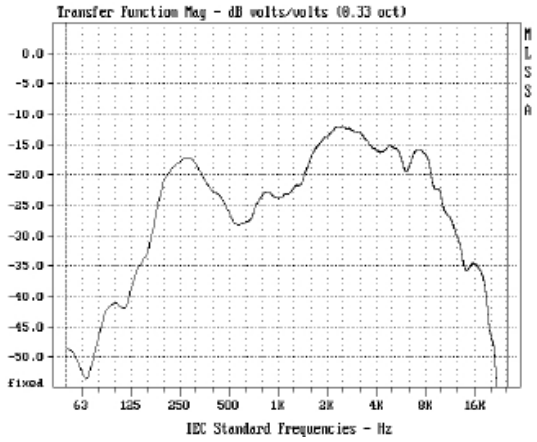
L. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.
1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

M. Voice Evacuation Control Panel
1. The Voice Evacuation Control Panel shall be a NOTIFIER FirstCommand NFC-50/100 and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall distribute and control emergency voice messages over the speaker circuits.
2. The Voice Evacuation Control Panel shall be UL 864 listed (Fire Protective Signaling), UL 2572 listed (Mass Notification), ULC listed and Compliant with Unified Facilities Criteria UFC 4-021-01.
3. The system shall provide the capability to interface to distributed voice evacuation control panels from the same manufacturer.

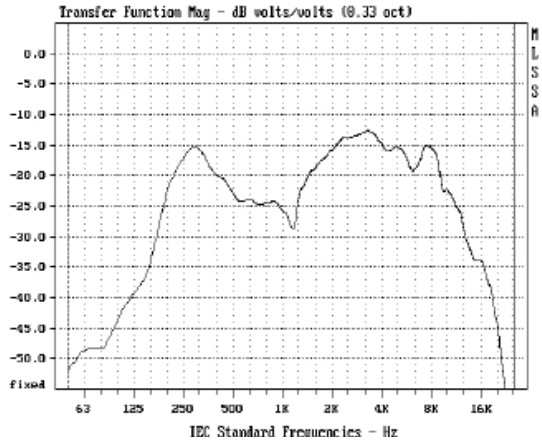
4. The Voice Evacuation Control Panel shall be activated by the Fire Alarm Control Panel via a direct serial connection allowing the Fire Alarm Control panel to control speaker circuit(s) and message activation.
5. Shall have as minimum requirements:
    a. Integral 50 Watt, 25 Vrms audio amplifier with optional converter for 70.7-volt systems. The main system shall be capable of expansion to 100 watts total via the insertion of an additional 50 watt audio amplifier module into the same cabinet.
    b. Speaker circuit that can be wired both Class A and / or B.
6. Integral Digital Message Generator with a memory capacity for up to fourteen messages, each message shall be up 60 seconds long. These messages shall field programmable without the use of additional equipment.
7. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
8. The Voice Control Panel will be capable of detecting and annunciating the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.
9. The Voice Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.
10. Speaker outputs shall be fully power-limited.
11. Amplifiers will be supplied power independently to eliminate a short on one circuit from affecting other circuits.
12. The Voice Control Panel will provide full supervision on both active (alarm or music) and standby conditions.
13. Optional distributed amplifier units shall be available to increase total system capacity to up to 24 speaker circuits and up to 1,100 watts of power.

N. System Sensor L-Series Speakers
1. The Speaker appliance shall be System Sensor L-Series model _____ Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

Ceiling Speaker
Wide Band Frequency Response



Wall Speaker
Wide Band Frequency Response



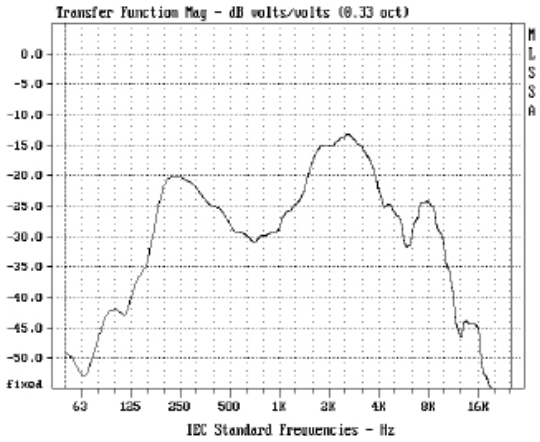
Note: The wide band frequency response is derived using MLS methods

O. System Sensor L-Series Speaker Strobes

1. The Speaker Strobe appliance shall be System Sensor L-Series model _____ Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, L-Series speaker strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

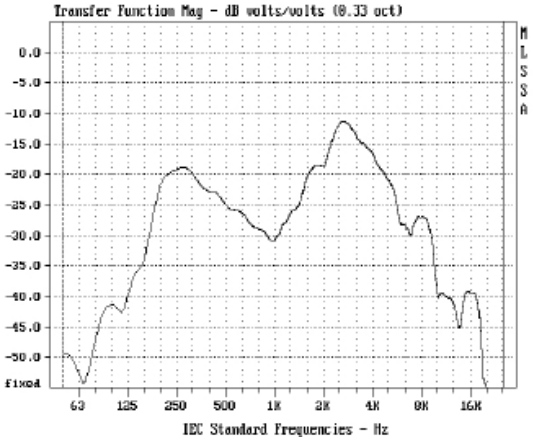
Ceiling Speaker Strobe

Wide Band Frequency Response



Wall Speaker Strobe

Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

L. When the system is equipped with a Voice Evacuation Control panel, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying voice messages.

3.3 FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 31 1000

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cleaning site of debris, grass, trees and other plant life in preparation for site or building excavation Work.
2. Protection of existing structures, trees or vegetation indicated to remain.
3. Stripping topsoil from areas indicated.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 01 3543 - Environmental Procedures: Recycling and reuse of waste materials.
2. Section 02 4113 - Selective Site Demolition: Demolition and removal of site structures.
3. Section 31 2000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Obtain required permits and licenses in accordance with requirements of Federal Clean Water Act (CWA) and Water Quality Act (WQA). File Notice of Intent (NOI) with United States Environmental Protection Agency, or appropriate state agency where project is located.
2. Provide temporary erosion control systems as indicated on to protect adjacent properties and water resources from erosion and sedimentation.
3. CWA (1972) and WQA (1987) Requirements:
a. Where Work on this project will disturb 5 or more acres, do not start Work without obtaining a "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from project site for duration of Contract. Prepare and obtain approval of a "Storm Water Pollution Prevention Plan" (SWP^3) that includes monitoring of erosion control measures for duration of Contract.
b. Provide storm water management in accordance with NPDES permit, SWP^3 and for any enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays and remedial actions resulting from failure to comply with all provisions of NPDES permit and SWP^3.
c. Keep SWP^3 on site and make available for inspection by appropriate authority having jurisdiction at any time.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:

1. Notify the General Services Director or Designee of variations to conditions or discrepancies in actual site conditions prior to start of site preparation Work.

2. Traffic: Conduct operations and removal of debris with minimum interference to roads, streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks or other facilities without permission from authorities having jurisdiction.
3. Protections: Provide protection for safe passage of persons around area of site preparation. Take precautions and conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
    a. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Friable clay loam surface soil containing humus, organic matter, found in a depth of not less than 4 inches free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other unsuitable material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Locate existing utilities as specified in Section 312000.
2. Verify that survey benchmark and intended elevations for the Work are as indicated and are not located in an area that may be damaged.
3. Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Provide temporary erosion control systems as indicated on Drawings or as directed by General Services Director or Designee to protect project site and adjacent properties and water resources from erosion and sedimentation.

3.3 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of Work as indicated on Drawings. Removal includes digging out stumps and roots. Fill depressions caused by clearing and grubbing operations to subgrade elevation. Prevent water ponding.

Place suitable fill material in horizontal layers not exceeding 8 inches loose depth, and compact as specified herein and in Section 312000.

C. Remove grass, trees, plant life, stumps and all other construction debris from site.
   1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the City of Torrance in the Solid Waste Management and Environmental Protection Plan.
      a. Mulch: Identify organic debris that is free of disease, pest infestation, and chemical contamination and that is suitable for recycling on site. Chip and compost suitable organic debris for use as mulch on site. Stockpile where indicated on Drawings or directed by General Services Director or Designee. Coordinate with mulch requirements of Section 32 9200 - Turf and Grasses and Section 329300 - Plants.

3.4 TOPSOIL EXCAVATION

A. Strip topsoil from areas that are indicated to be filled, excavated, landscaped, or re-graded to depth that prevents contact with underlying subsoil or unsuitable material. Where trees are indicated to remain, stop topsoil stripping sufficient distance from tree to prevent damage to main root system.

B. Cut heavy growths of grass from areas prior to start of stripping. Remove heavy growths of grass along with clearing of other vegetation materials.

C. Topsoil: Organic surface soil found in depth not less than 6 inches.

D. Satisfactory Topsoil: Soil reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other unsuitable material.

E. Stockpile topsoil where indicated on Drawings or directed by General Services Director or Designee. Construct stockpile areas to positively drain surface water. Cover stockpile areas as required to prevent windblown dust. Dispose of unsuitable topsoil off-site as specified clearing, unless directed otherwise by General Services Director or Designee. Dispose of excess topsoil off-site as specified for clearing, unless directed otherwise by General Services Director or Designee.

3.5 REMOVAL

A. Remove debris, rock, extracted plant life, paving, curbs, and other structures indicated on Drawings as specified in Section 024113.
   1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the City of Torrance in the Solid Waste Management and Environmental Protection Plan.

3.6 PROTECTION

A. Protect existing streets, structures, and utilities as specified in Section 312000.

B. Protect trees, plant growth, and features indicated to remain.

C. Protect natural resources as specified in Section 013543 - Environmental Procedures and as approved by the City of Torrance in the Solid Waste Management and Environmental Protection Plan.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of subgrade for building, slabs, walks, pavements, and other sitework.
2. Rough and finish grading.
3. Excavation for filling and grading.
4. Filling and subgrade preparation.
5. Geotechnical Data

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 01 3543 - Environmental Procedures: Recycling and reuse of waste materials, and protection of natural resources
2. Section 02 4113 - Selective Site Demolition: Demolition and removal of designated existing site items.
3. Section 31 1000 - Site Clearing: Clearing site of debris, grass, trees, and other plant life.
4. Section 31 2300 - Excavation and Fill: Earthwork for structures, utilities, and pavement.
5. Section 31 3200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.
6. Section 31 2500 - Erosion and Sedimentation Controls: Temporary and permanent erosion control and slope protection systems.
7. Section 31 2317 - Rock Excavation: Removal of rock during excavation.
8. Section 32 9113 - Soil Preparation: Placing topsoil and fine grading.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C 136 - Method for Sieve Analysis of Fine and Course Aggregates.
2. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
5. ASTM D 2167 - Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method.
6. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D 2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D 3017 - Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
9. STM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T 88 - Particle Size Analysis of Soils

1.3 DEFINITIONS

A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet 0 inches beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Shop Drawings:
      a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
      b. Submit drawings or details of design for use of fabrics or geogrids.
   2. Assurance/Control Submittals:
      a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the Work. Change of source requires General Services Director or Designee approval.
      b. Test Reports: Submit the following reports directly to General Services Director or Designee from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
         1) Test reports on borrow material.
         2) Verification of each footing subgrade.
         3) Field density test reports.
         4) Optimum moisture-maximum density curve for each type of soil encountered.
         5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
      c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
      d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.

B. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Project Record Documents: Accurately record final grade contours, spot elevations, and slope gradients.

1.5 QUALITY ASSURANCE

A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.

C. Pre-Installation Meetings:
   1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
   2. Require attendance of parties directly affecting Work of this Section.
   3. Review conditions of earthwork operations, earthwork procedures and coordination with related Work.
   4. Agenda:
      a. Tour, inspect, and discuss conditions of existing soils and soil substrates.
      b. Review dust control measures and their requirements.
      c. Review required submittals, both completed and yet to be completed.
      d. Review Survey and Civil sitework Drawings.
      e. Approve proposed earthwork equipment.

f. Approve excess material dump location.
g. Approve import material storage location.
h. Review and finalize construction schedule related to earthwork and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
i. Review required inspections, testing, certifying, and material usage accounting procedures.
j. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
k. Review safety precautions relating to earthwork operations.
l. Review environmental procedures.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:
1. Geotechnical Data:
a. Soils investigation reports and data are not a part of Contract Documents.
b. Soil and subsurface investigations were conducted at site by an Independent Testing Laboratory and a report with log of borings prepared. Report was obtained for Architect and Engineer design use only.
c. Soils investigation data is not warranted to indicate actual conditions. City of Torrance, Architect, and Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils. City of Torrance, Architect and Engineer disclaim responsibility for accuracy, true location, and extent of soils investigation prepared by others; and further disclaim responsibility for interpretation of data by Contractor such as projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
d. Contractor may make additional test borings and other exploratory operations at no additional cost to City of Torrance. Coordinate tests with General Services Director or Designee.
2. Classification of Excavations: Contractor acknowledges that Contractor has investigated project site to determine type, quantity, quality, and character of excavation work to be performed. Consider excavation as unclassified excavation, except where Rock Excavation is required. Rock Excavation criteria is as follows:
a. Rock Excavation Not Indicated in Report of Subsurface Exploration:
1) Notify General Services Director or Designee immediately, and in writing, prior to start of Rock Excavation operations.
2) General Services Director or Designee will visit Project Site, verify requirement for Rock Excavation, determine estimated quantity Rock Excavation required, and provide Contractor written authorization to proceed.
3) General Services Director or Designee will verify measurements and quantities of actual Rock Excavation required and make adjustments to Contract as specified in Section 012600.
b. Rock excavation specified in Section 312317.
3. Existing Utilities: Contact local utility companies and make arrangements to obtain utility company location and marking service prior to start of Earthwork operations.
a. Locate existing underground utilities in areas of Work. If utilities are to remain in place, provide means of support and protection during Earthwork operations.
1) Pothole and locate existing underground utilities at locations to assure that no conflict with Work of this Contract will occur and required clearance is available to prevent damage to existing utilities.
2) Perform potholing minimum 10 days before start of excavation or underground work.
b. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility company and General Services Director or Designee immediately for directions.
c. Coordinate with General Services Director or Designee and utility companies to keep existing utility services and facilities in operation.

d. Repair damaged utilities to satisfaction of utility company, at no additional cost to City of Torrance.
e. Do not interrupt existing utilities serving facilities occupied and used by City of Torrance or others, during occupied hours, except when permitted in writing by General Services Director or Designee and then only after acceptable temporary utility services have been provided and approved by General Services Director or Designee.
f. Demolish and completely remove from site existing underground utilities indicated on Drawings to be removed as specified in Section 024113. Coordinate with utility companies for shut-off of services if lines are active.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subsoil: Approved by Testing Laboratory and General Services Director or Designee.
1. Excavated and re-used material, Imported Borrow, Select or local borrow, Structural.
2. Graded.
3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
4. Conforming to ASTM D 2487

B. Aggregate: Approved by Testing Laboratory and General Services Director or Designee.
1. Coarse Aggregate: Approved stone; free of shale, clay, friable material and debris; graded in accordance with ASTM D 2487 Group Symbol [GW] [GP] [GM] [GC]; within the following limits:

SIEVE SIZE	PERCENT PASSING
2 inches	100
1 inch	95
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10

2. Pea Gravel: Natural Stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM D 2487 Group Symbol [GM] [GC] [____]; to the following limits:
a. Minimum Size: 1/4 inch.
b. Maximum Size: 5/8 inch.
3. Fine Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM D 2487 Group Symbol [SW] [SP] [SM] [SC] within the following limits:

SIEVE SIZE	PERCENT PASSING
No. 4	100
No. 14	10 to 100
No. 50	5 to 90
No. 100	4 to 30
No. 200	0

C. Topsoil: Approved by Testing Laboratory and General Services Director or Designee.
1. Excavated and reused material.
2. Graded.
3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
4. Conforming to ASTM D 2487 Group Symbol OH, PT.

D. Topsoil: Approved by Testing Laboratory and General Services Director or Designee.

1. Imported borrow.
2. Friable loam.
3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
4. Acidity range (pH) of 5.5 to 7.5
5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
6. Conforming to ASTM D 2487 Group Symbol OH, PT.
7. Limit decaying matter to 5 percent of total content by volume.

E. Filter/Drainage Fabrics:
1. Mirafi 140N.
2. Amoco Style #4546.
3. DuPont Typar 3341.

F. Soil Stabilization Materials: Specified in Section 313200.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing Laboratory services.
B. Testing and Analysis:
1. Soil: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], and [ASTM D 3017].
2. Aggregate: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], [ASTM D 3017], [ASTM D 4318], and [ASTM C 136].

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
1. Verify that existing site soils and soil conditions encountered are as indicated in Geotechnical Data.
2. Verify quantity and type of each soil material before start of material installation.
3. Backfilling:
a. Verify imported fill and stockpiled fill to be reused is approved.
b. Verify foundation perimeter drainage installation has been inspected and approved.
c. Verify foundation or basement walls are braced to support surcharge forces imposed by backfilling operations.
d. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Clear site as specified in Section 311000.

B. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.

C. Examine Project Site with General Services Director or Designee before start of earthwork operations. Identify areas and prepare to brace or shore areas of adjacent property subject to rotation, slumping, or cave-in to prevent dislocation of adjacent soil, pavement, utilities, structures, or other items to remain.

D. Verify that survey benchmark and intended elevations for Work are as indicated on Drawings. Short form contour designations are intended to be a continuing of the long form bench mark.

E. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
   1. Notify General Services Director or Designee and utility company immediately of utilities, not indicated on Drawings, encountered.
   2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
   3. Comply with utility company requirements and directions of General Services Director or Designee to keep utilities in operation.
   4. Repair damage to utilities as directed by General Services Director or Designee.

F. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.

G. Protect benchmarks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.

H. Remove material encountered in grading operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and as directed by General Services Director or Designee. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.

I. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
   1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use pumping equipment.
   2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using equipment and methods keeping natural soils underlying low areas dry and undisturbed.
   3. If proposed for fill, dry muck, mud, and other materials removed from low areas on-site by spreading in thin layers for inspection by Testing Laboratory and General Services Director or Designee. Place material determined by the Testing Laboratory and General Services Director or Designee suitable for use as fill material into lowest elevation of site filling operation. Do not place under building subgrade pad or paving subgrade. If material is determined by the Testing Laboratory and General Services Director or Designee to be unsuitable, remove material from site.

3.3 EXCAVATION FOR FILLING AND GRADING

A. Provide dewatering, drainage, and ground water management to control moisture of soils when performing grading operations during periods of wet weather.

B. Shore, brace, and drain excavations to maintain excavations safe, secure, and free of water at all times.

C. Provide protection for workers within trench areas in accordance with local, State, and Federal Occupational Safety and Health requirements and regulations.

D. Unacceptable Fill Material for Building and Paving Areas: Excavated material containing rock or stone greater than 6 inches in largest dimension.

E. Acceptable Fill Material:
   1. Rock or stone less than 6 inches in largest dimension as fill to within 24 inches of surface of proposed subgrade when mixed with suitable material.
   2. Rock or stone less than 2 inches in largest dimension mixed with suitable material as fill within the upper 24 inches of proposed subgrade.

3.4 FILLING AND SUBGRADE PREPARATION

A. Fill areas to contours and elevations as indicated on Drawings with materials specified herein.

B. Place fill in continuous lifts as specified herein.

C. Refer to Section 312300 for filling requirements for structures, utilities, and pavements.

D. Areas Exposed by Excavation or Stripping:
   1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum depth per soils report.
   2. Compact to minimum 95 percent optimum density in accordance with ASTM D 698 or 92 percent optimum density in accordance with ASTM D 1557 at minimum moisture content 1 percent below and maximum 3 percent above optimum moisture content.
   3. Proofroll to detect any areas of insufficient compaction by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck, or General Services Director or Designee approved equivalent, in each of two perpendicular directions under supervision and direction of Testing Laboratory and General Services Director or Designee.
   4. Excavate and recompact areas failing to meet specified requirements.

E. Fill Material Placement:
   1. Place in 8 inch maximum lifts compacted minimum 95 percent optimum density in accordance with ASTM D 698 or 92 percent optimum density in accordance with ASTM D 1557 at minimum moisture content of 1 percent below and maximum moisture content 3 percent above optimum moisture content.

F. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.5 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades for conformance to elevations as indicated on Drawings and for specified conditions for subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.

C. Remove areas of finished subgrade with compaction density below specified density to depth required as directed by Testing Laboratory and General Services Director or Designee. Fill removed areas and compact to specified compaction density

D. Provide surface of subgrade after compaction hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Grade areas other than paved areas and building pad areas to finish grade elevations or contours as indicated on Drawings including the following:
   1. Excavated areas.
   2. Filled and transition areas.
   3. Landscaped areas.

B. Provide finish graded areas uniform and smooth, free from rocks, debris, or irregular surface changes with maximum tolerance of 0.10 feet above or below established finish subgrade elevation. Provide graded surfaces sloping uniformly between indicated elevations.

C. Provide drainage ditches graded with uniform slope to allow drainage without ponding, minimizing potential for erosion. Refer to Section 312500 for procedures to protect slopes and control erosion.

D. Refer to Section 313200 for soil stabilization using lime, cement, fly ash and geotextile fabric methods for subbase materials.

E. Refer to Section 329113 for placing topsoil and fine grading in landscaped areas.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Excavation: Notify Testing Laboratory and General Services Director or Designee for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

C. Site Tests - Quantity:
   1. Building Area Subgrade Pad:
      a. Cut Areas: Minimum one compaction test for every 2500 square feet.
      b. Fill Areas: Minimum one compaction test for every 2500 square feet for each 8 inch lift, measured loose.
   2. Areas Outside Building Area Subgrade Pad:
      a. Cut Areas: Minimum one compaction test for every 10,000 square feet.
      b. Fill Areas: Minimum one compaction test for every 10,000 square feet for 8 inch lift, measured loose.

D. Site Tests - Methods:
   1. Perform tests on each type of existing on-site or imported off-site material used for compacted fill.
      a. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
      b. Mechanical Analysis: AASHTO T-88
      c. Plasticity Index: ASTM D 4318
         1) One optimum moisture-maximum density curve for each type of soil encountered.
         2) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
   2. Perform field density tests for in-place materials in accordance to one of the following standards:
      a. Sand-Cone Method: ASTM D 1556
      b. Balloon Method: ASTM D 2167
      c. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
   3. Perform a CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) test for each type of imported off-site material in areas where pavement will be placed.

E. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to City of Torrance.

3.8 PROTECTION

A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.

B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.

C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.

END OF SECTION

SECTION 312300

EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating and backfilling for structures, utilities, and pavement.
2. Pipe bedding.
3. Compacting fill materials.
4. Borings and casings under roads.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 31 2000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.
2. Section 31 2317 - Rock Excavation: Removal of rock during excavation.
3. Section 31 3200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
2. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T 180 - Moisture-Density relations of Soils Using a 10 Pound Rammer and an 18 Inch Drop.

C. American Water Works Association (AWWA):
1. AWWA C 200 - Steel Water Pipe, 6 Inch and Larger.
2. AWWA C 206 - Field Welding of Steel Water Pipe.

D. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electric code.

1.3 DEFINITIONS

A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Shop Drawings:

a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
b. Shop Drawings or details pertaining to Site Utilities are not required unless required by regulatory authorities or unless use of materials, methods, equipment, or procedures are contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been approved by General Services Director or Designee.

2. Assurance/Control Submittals:
a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires General Services Director or Designee approval.
b. Test Reports: Submit the following reports directly to General Services Director or Designee from Testing Laboratory, with copy to Contractor:
1) Test reports on borrow material.
2) Verification of each footing subgrade.
3) Field density test reports.
4) Optimum moisture-maximum density curve for each type of soil encountered.
5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following.
a. Spot elevations for building area subgrade pad.
b. Location of existing utilities remaining, re-routed utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions: Requirements specified in Section 312000.

B. Existing Utilities: Requirements specified in Section 312000.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stockpiled on-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by General Services Director or Designee.

B. Imported off-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by General Services Director or Designee.

C. Pipe Bedding Material: Processed sand and gravel free from clay lumps, organic, or other deleterious material complying with the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
1 Inch	100
3/4 Inch	90 to 100
3/8 Inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

D. Steel Casing Pipe: AWWA C 200, minimum grade B; size and wall thickness as indicated on Drawings.

E. Stabilization Fabrics and Geogrids:
1. Mirafi 500X or 600X.
2. Amoco Style #2002 Woven.
3. Reemay Typar 3401 and 3601.
4. Trevira S1114 and S1120.
5. Tensar 1100 and 1200.

F. Filter/Drainage Fabrics:
1. Mirafi 140 N.
2. Amoco Style #4546.
3. Reemay Typar 3341.
4. Carthage Mills, Carthage 6%.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to City of Torrance.

3.2 PREPARATION

A. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.

B. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.

C. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
1. Notify General Services Director or Designee, municipality, and utility company immediately of utilities, not indicated on Drawings, encountered.

2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
3. Comply with utility company requirements and directions of Construction Manager to keep utilities in operation.
4. Repair damage to utilities as directed by General Services Director or Designee.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.

E. Protect bench marks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.

F. Overexcavate areas of building subgrade found consisting of unsuitable materials as determined by Testing Laboratory and General Services Director or Designee. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.3 EXCAVATION

A. Excavation for filling and grading specified in Section 312000.

B. Rock excavation specified in Section 312317.

C. Excavation for Structures:
1. Excavate subbase for building foundations, slabs-on-grade and site structures to width and depth indicated on Drawings.
   a. Cut excavation banks vertically.
   b. Remove rocks, loose soil, and debris from bottom of excavation.
   c. Overexcavate wet or unsuitable soil from bottom of excavation.
   d. Provide stable base for concrete reinforcing installation and concrete placement.
   e. Hand trim to indicated lines and grades just prior to concrete reinforcing installation.
2. Provide protection for workers within trench areas in accordance with local, state, and national Occupational Safety and Health requirements and regulations.
   a. Trenches minimum 4 feet in depth.
3. During excavation, stockpile materials suitable for backfilling away from excavation to prevent overloading, slides, or cave-ins.
4. Remove material encountered in excavating operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and General Services Director or Designee. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
5. Prevent surface water from flowing into excavations by temporary grading or other approved methods.
   a. Do not allow water to accumulate in excavations.
   b. Remove accumulated water in excavations.
   c. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components required to remove water from excavations.

D. Excavation for Utilities:
1. Excavate trench width and depth required for laying pipe, conduit, or cable. Cut trench banks vertical. Remove stones from bottom of trench as required to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as required to provide suitable base for continuous and uniform bedding.
2. During excavation, stockpile materials suitable for backfilling away from trench bank to prevent overloading, slides, or cave-ins.
3. Remove material encountered in trenching operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and General Services Director or

Designee. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.

4. Prevent surface water from flowing into trenches or other excavations by temporary grading or other approved methods.
   a. Do not allow water to accumulate in excavations.
   b. Remove accumulated water in excavations.
   c. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components required to remove water from excavations.
5. Open cut excavation using trenching machine or backhoe. Do not use dirt clods for backfill created by use of machines other than ladder or wheel-type trenching machines.
6. Grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material along entire trench length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Do not excavate trench deeper, longer, or wider than required to make proper joint connection.
7. Excavate trench width below the top of pipe minimum 300 mm wide and maximum 460 mm wider than outside surface of pipe or conduit installed to elevations and grades indicated on Drawings. Excavate trench width for other pipe, conduit, or cable to least practical width allowing for proper compaction of trench backfill.
8. Excavate trench depth measured from finished grade or paved surface to the following requirements or applicable codes and ordinances:
   a. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line established by local building official, whichever is deeper.
   b. Sanitary Sewer: Elevations, and grades indicated on Drawings.
   c. Storm Sewer: Depths, elevations, and grades indicated on Drawings.
   d. Electrical Conduits: 24 inches minimum to top of conduit or as required by NFPA 70, or local utility company requirements, whichever is deeper.
   e. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
   f. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
   g. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.
9. Provide shoring, sheeting, and bracing, as required, in trenches and other excavations where protection of construction personnel is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

E. Excavation for Pavement:
   1. Excavate roadway and pavement areas to line and grade indicated on Drawings.
   2. Stockpile excavated material suitable for backfilling on-site.
   3. Remove excavated materials not required or not suitable for backfill from site.
   4. Overexcavate areas of pavement subgrade found to contain unsuitable material. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.4 PIPE BEDDING

A. Excavate trenches, for pipe or conduit installed to elevations indicated on Drawings, 4 inches below bottom of pipe and to width as specified. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel. After pipe installation, backfill and compact to top of trench.

B. Place geotextile fabric as indicated on Drawings.

3.5 BACKFILLING AND SUBGRADE PREPARATION

A. Backfilling:
   1. Verify that imported off-site fill and stockpiled on-site fill is tested and approved.
   2. Verify that foundation perimeter drainage installation is inspected and approved.
   3. Verify that foundation or below grade structure walls are braced to support surcharge forces imposed by backfilling operations.
   4. Verify that backfill areas are free of debris, snow, ice, or water, and that ground surfaces are not frozen.

B. Prepare building area subgrade pad in accordance with foundation subsurface preparation information indicated on Drawings and specified herein. Do not use rock larger than 6 inches for building subgrade fill.

C. Areas Exposed by Excavation or Stripping:
   1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum 8 inch depth.
   2. Compact to minimum 95 percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content 1 percent below and maximum 3 percent above optimum moisture content.
   3. Proofroll to detect any areas of insufficient compaction by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck, or General Services Director or Designee approved equivalent, in each of two perpendicular directions under supervision and direction of General Services Director or Designee.
   4. Excavate and recompact areas failing to meet specified requirements.

D. Fill Material Placement:
   1. Place in 8 inch maximum lifts compacted minimum 95 percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content of 1 percent below and maximum moisture content 3 percent above optimum moisture content.
   2. Maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used as fill in the specified areas, unless indicated otherwise on Drawings:

	LOCATION	PI	LL
a.			
b.	Building area, below upper 4 feet	30	40
c.	of proposed subgrade elevation		
d.	Building area, upper 4 feet	20	30
e.	of proposed subgrade elevation		
f.	Paving area, below upper 4 feet	30	40
g.	of proposed subgrade elevation		
h.	Paving area, upper 4 feet	20	30
i.	of proposed subgrade elevation		

E. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.6 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades for elevations indicated on Drawings and specified conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.

C. Remove areas of finished subgrade found to have insufficient compaction density. Replace in a manner that will comply with compaction requirements as directed by General Services Director or Designee.

Provide hard, uniform, smooth, stable surface, true to grade and cross-section after completion of compaction.

3.7 BORINGS AND CASINGS UNDER ROADS

A. Install street, road, or highway crossings for utility mains by jacking and boring method in accordance with requirements of governing authorities having jurisdiction.

B. Locate approach pits and trenches within right- of-way of street, road, highway, or railroad distance from paving permitting traffic to pass without interference. Tamp backfill for approach pits and trenches within right- of-way in layers not greater than 6 inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density obtained at optimum moisture as determined by AASHTO T 180, Method A (Modified Proctor). Mechanical tampers may be used after cover of 6 inches has been obtained over top of pipe barrel.

C. Use commercial type boring rig providing hole bored to proper alignment and grade within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made, and in no instance shall hole be left open while unattended.

D. Clean and prime interior and exterior of casing pipe; apply two coats of asphalt in accordance with requirements of governing authorities having jurisdiction.

E. Butt weld steel casing. Weld using full penetration single butt-welds in accordance with AWWA C 206.

F. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with requirements of governing authorities having jurisdiction.

G. Paving Damage Caused by Contractor Construction Operations:
   1. Repair paving where cracks occur on either side of line where pipe was installed by removing damaged paving between cracks, sawcutting paving in straight line at a point sufficiently beyond location of cracks for repair, and placing new paving to match existing in areas where paving removed.
   2. Make repairs to the satisfaction of paving owner.
   3. Make repairs at no additional cost to City of Torrance within one year from Date of Substantial Completion.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Excavation: Notify Testing Laboratory and General Services Director or Designee for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

C. Site Tests:
   1. Specified in Section 312000.
   2. Tests for Building Area Subgrade Pad:
      a. Cut Areas: Minimum one compaction test for every 2500 square feet.
      b. Fill Areas: Minimum one compaction test for every 2500 square feet for each 8 inch lift measured loose.
   3. Tests for areas outside building area subgrade pad specified in Section 312000.

D. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact and retest at no additional cost to City of Torrance.

3.9 PROTECTION

A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.

B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.

C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.

END OF SECTION

SECTION 31 2317

ROCK EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removal of identified and discovered rock during excavation.
2. Incorporating removed rock into fills and embankments.
3. Use of explosives NOT PERMITTED to assist rock removal.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 31 2000 - Earth Moving: Cutting, Filling, and grading for site improvements.

2. Section 31 2300 - Excavation and Fill: Earthwork for structures, utilities and pavement.

1.2 REFERENCES - None

1.3 SUBMITTALS - None

1.4 QUALITY ASSURANCE

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Determine all environmental effects associated with proposed rock removal Work and safeguard those concerns as regulated by law and authorities having jurisdiction by approved methods.

B. Explosives: Not permitted.

C. Existing Conditions:
1. Geotechnical Data:
a. Reports of Subsurface Investigation and data are not a part of Contract Documents.
b. Soil and subsurface investigations were conducted at the site by an independent testing laboratory and a report with log of borings prepared. This report was obtained for CITY OF TORRANCE design use only.
c. A copy of the report is provided by General Services Director or Designee and is made available for convenience of the Contractor.
d. Soils investigation data is not warranted to indicate actual conditions. Owner and Architect/Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils; they disclaim responsibility for accuracy, true location, and extent of soils investigation that has been prepared by others; and they further disclaim responsibility for

interpretation of that data by Contractor as in projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.

e. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to City of Torrance.

2. Immediately report any discrepancy between Contract Documents and amount and type of rock to be removed to General Services Director or Designee.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for rock excavation to begin.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 ROCK EXCAVATION

A. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 31 2000. Remove rock to limits indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

B. Rock Excavation - Mechanical Method:

1. Excavate for and remove rock by mechanical method. Drill holes and utilize expansive tools and wedges to fracture rock.
2. Cut away rock at excavation bottom to form level bearing. Remove shaled layers to provide sound and unshattered base for foundations.
3. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
4. Remove shaled layers to provide sound unshattered base for footings and foundations.
5. Re-use excavated rock materials on-site in accordance with Section 312000.
6. Remove excavated rock materials not re-used off-site.

3.3 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field inspection.

B. Inspection: General Services Director or Designee will inspect bearing surfaces and cavities formed by removed rock.

END OF SECTION

SECTION 31 2500

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Temporary and permanent erosion control systems.
   2. Slope protection systems.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 31 3200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for Quality Assurance/Control submittals.
   1. Material Source: Submit name of material suppliers.
   2. Provide materials from same source throughout Work. Change of source requires General Services Director or Designee approval.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Protect adjacent properties and water resources from erosion and sediment damage throughout Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick Growing Grasses: Wheat, rye, or oats.

B. Straw Bales: Free of weed seed.

C. Fencing for Siltation Control: Indicated on Drawings.

D. Erosion Control Blankets and/or Erosion Control Geotextiles.

E. Bale Stakes:
   1. Minimum 4 feet length.
   2. 2 No. 4 steel reinforcing bars or,
   3. 2 steel pickets or,
   4. 2 - 2x2 inch hardwood stakes driven 18 inches to 24 inches into ground.

F. Temporary Mulches: Loose straw, netting, wood cellulose, or agricultural silage free of seed.

G. Metal Fence Stakes: Minimum 8 foot length.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to City of Torrance.

3.2 PREPARATION

A. Review Stormwater Pollution Prevention Plan SWP^3.

B. Notify General Services Director or Designee of deficiencies or changes in Stormwater Pollution Prevention Plan SWP^3 required by current site conditions. Revisions of plan will be made as determined by General Services Director or Designee.

3.3 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. General Services Director or Designee may direct Contractor to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and embankment operations and may direct Contractor to provide immediate permanent or temporary pollution control measures.

B. Provide permanent erosion control measures at earliest practical time to minimize requirement for temporary erosion controls. Permanently seed and mulch cut slopes as excavation proceeds.

C. Maintain temporary erosion control systems installed by Contractor as directed by General Services Director or Designee to control siltation at all times throughout Work. Provide maintenance or additional Work directed by General Services Director or Designee within 48 hours of notification by General Services Director or Designee.

D. Apply soil stabilization as specified in Section 31 3200 or seed slopes that may be easily eroded with wheat, rye or oat grasses.

END OF SECTION

SECTION 313100

SOIL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil treatment for termite control.
   2. Application below grade and at interior and exterior foundation perimeter.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. United States Environmental Protection Agency (EPA):
   1. EPA - Federal Insecticide, Fungicide, and Rodenticide Act.

1.3 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   a. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.

B. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Project Record Documents: Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.
   2. Warranty: Submit manufacturer warranty with forms completed in City of Torrance name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience and licensed in accordance with regulations of authorities having jurisdiction for application of chemical toxicant.

B. Regulatory Requirements: Conform to applicable code for application requirements, application licensing, authority to use toxicant chemicals, and in accordance with EPA regulations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver products in manufacturer's original unopened containers with labels intact, identifying Product and manufacturer, application instructions, and EPA federal registration number.

C. Do not store Products on site. Deliver Products to site at time of application.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Do not apply soil treatment to frozen or wet soils or during rain or snow.

1.7 WARRANTY

A. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:
   1. Submit written warranty signed by soil treatment applicator and Contractor certifying that applied chemical toxicant treatment will prevent infestation of subterranean termites.
      a. State that application was made at concentration, rates, and methods as specified.
      b. State that if subterranean termite activity is discovered during warranty period, Contractor will retreat soil and repair damage caused by termite infestation at no additional cost to City of Torrance.
   2. Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.
   3. Provide for inspection of Work annually; report in writing to designated City of Torrance personnel.
   4. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. EPA and local authority having jurisdiction approved chemical toxicant; water based emulsion, uniform composition, with synthetic dye to permit visual identification of treated soil, bearing Federal registration number of the EPA.

B. Specially formulated to prevent infestation by termites.

C. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MIX DILUTION

A. Dilute and mix toxicant chemical to manufacturer's published instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.
   2. Verify final grading is complete.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Remove foreign matter, loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations.

3.3 APPLICATION

A. Apply toxicant within 12 hours before installation of vapor retardant under slab-on-grade.

B. Apply toxicant to soil in strict accordance with federal and local jurisdiction requirements and manufacturer's printed application rates.

C. Apply toxicant as a coarse spray; provide uniform metered distribution.

D. Post signs in areas of application to warn workers that toxicant has been applied to soil. Remove signs after areas are covered by other construction.

E. Reapply toxicant to areas disturbed by subsequent excavation, landscape grading, or other construction activities occurring after initial toxicant application.

3.4 CONSTRUCTION

A. Interface with Other Work:
   1. Coordinate application of toxicant at foundation perimeter with finish grading and landscaping work; avoid disturbance of treated soil.

3.5 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Inspect and test soil areas where toxicant was applied to determine the presence of any remaining termites before covering with subsequent construction.

C. Reapply toxicant to areas where inspection or testing identifies the presence of termites. Use same toxicant as for original treatment.

END OF SECTION

SECTION 32 0190

OPERATION AND MAINTENANCE OF PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor maintenance of exterior plants, lawns, and grasses.
   2. Contractor maintenance of irrigation system.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 01 7704 - Closeout Procedures and Training: Maintenance data and Maintenance Manuals.
   2. Section 32 9200 - Turf and Grasses: Grass, sod, and sprigs.
   3. Section 32 9300 - Plants: Planting materials.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Operation and Maintenance Data:
      a. Instructions indicating procedures to be used by City of Torrance personnel for maintenance of plants and groundcover during one typical year including variations of maintenance for climatic conditions throughout the year. Include instructions and procedures including but not limited to the following:
         1) Watering.
         2) Promotion of growth.
         3) Fertilizing.
         4) Mowing.
         5) Pruning.
         6) Pesticides.
         7) Maintenance of irrigation system components.
      b. Submit in conformance with requirements for maintenance data specified in Section 01 7704.
      c. Include approved Maintenance Instructions into Operation and Maintenance Manual prepared as part of requirements specified in Section 01 7704.
   2. Application Records: Maintain record of chemical applications, indicating the following. Include records as part of maintenance data specified in Section 01 7704.
      a. Dates of application.
      b. Type of chemical applied.
      c. Location and planting area applied.
      d. Application rate.
   3. Assurance/Control Submittals:
      a. Qualification Documentation: Submit planting and irrigation maintenance provider documentation of experience indicating compliance with specified requirements.

1.3 QUALITY ASSURANCE

A. Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Pre-Installation Meetings:
   1. Convene a pre-installation meeting one week prior to commencing start of plant maintenance period.
   2. Require attendance of parties directly affecting Work of this Section.
   3. Review conditions of operations, procedures and coordination with related Work.
   4. Agenda:
      a. Tour, inspect, and discuss conditions of exterior plants, lawns, grasses, and irrigation system.
      b. Review plant maintenance, irrigation system maintenance, and their requirements.
      c. Review required inspections.
      d. Review environmental procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Resource Management:
   1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
      a. Soil amendments: No chemical fertilizers; use organic matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
      b. Mulch: Provide organic mulch products.
   2. Recycled Content:
      a. Wood fiber mulch: Provide products manufactured from 100 percent post-consumer paper content and yard trimming composts.
      b. Mulch from recycled site debris: Coordinate with Section 31 1000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.

1.5 WARRANTY

A. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:
   1. Warrant to remove defective plants, including those that have died, have unsatisfactory growth, and have lost their original form, and replace with new healthy plants of same genus, species, variety, and size, within 10 days of discovery.
   2. Warranty does not include plants damaged by vandalism or severe weather.
   3. Warranty Period: 1 year maintenance period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Specified in Section 32 9200 and Section 32 9300.

B. Indicated on Drawings.

PART 3 - EXECUTION

3.1 ESTABLISHMENT PERIOD

A. Specified in Section 32 9200 and Section 32 9300.

3.2 MAINTENANCE PERIOD

A. One year from date of initial acceptance. Maintenance Period end date established by General Services Director or Designee.

3.3 IRRIGATION SYSTEM

A. Remove sand and debris from irrigation piping causing restrictions within emitter discharge orifices.

B. Program automatic electric controllers for optimum watering of plant materials while maintaining water conservation practices. Adjust irrigation program to compensate for seasonal water requirements.

C. Operate flush valves on emitter lateral lines.

D. Repair damage caused by maintenance work. Replace damaged irrigation components which cannot be repaired with new functioning components.

3.4 WATERING

A. Water landscaping at programmed intervals to maintain good color and sturdy growth of plant materials.

3.5 CHEMICAL CONTROLS

A. Fertilize to promote healthy plant growth without encouraging excessive top foliar growth. Do not apply high nitrogen fertilizer in late fall. Application at that time may promote frost tender foliar growth.

B. No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.

3.6 WEED CONTROL

A. Control weeds with use of herbicides, filter fabric weed barrier and, preferably, by manual removal of weeds.

B. Remove noxious weeds common to the area from planting areas by mechanical means.

C. Apply herbicide in accordance with manufacturer's published instructions.

D. Do not apply pre-emergent herbicides in areas to be seeded for lawns or native seed areas.

3.7 PEST AND DISEASE CONTROL

A. Apply pest and disease control chemicals in accordance with manufacturer's published instructions.

B. Spray or dust using appropriate insecticide, miticide and fungicide and as necessary to maintain plants in healthy and vigorous growing condition.

C. No chemical pesticides; use organic/natural matter for pest and disease control.

3.8 TREE STAKING AND GUYING

A. Stake or guy trees as specified in Section 32 9300 and as indicated on Drawings.

B. Inspect staking and guying at least two times per year and make necessary adjustments to prevent girdling or chafing of bark.

3.9 PRUNING

A. Prune or head back plants in keeping with nature and character of plants.

B. Seal 1 inch or greater cuts with tree seal.

C. Establish radial branch orientation and eliminate narrow V-shaped forks, cross-over branching, and branches that rub against each other.

3.10 TOPSOIL EROSION

A. Replace topsoil in areas experiencing noticeable soil erosion and make minor repairs necessary to avoid further erosion.

B. Notify General Services Director or Designee of unusual causes of erosion immediately.

3.11 CLEANING

A. Remove litter and dead vegetation from job site within 24 hours of discovery.

B. Broom clean paved surfaces at minimum 21 day intervals.

3.12 END OF MAINTENANCE

A. Within 2 weeks prior to end of maintenance period, apply an approved commercial fertilizer at rate recommended by manufacturer uniformly over planted areas.

B. At end of maintenance period and when ground covers have established and landscaping and irrigation work is complete, request End of Maintenance Period Inspection by General Services Director or Designee.

C. When landscaping work is found to be satisfactory, maintenance period will end on Date of Final Acceptance established by General Services Director or Designee.

D. When work is found to be unsatisfactory, maintenance period will be extended at no additional cost to City of Torrance until work has been completed, inspected and accepted by General Services Director or Designee.

E. Contractor is to maintain plants for one year from completion.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bituminous concrete paving.
2. Surface course.
3. Binder course.
4. Paving base course.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 31 2000 - Earth Moving: Earthwork for Pavement.
2. Section 32 1313 - Concrete Paving: Concrete paving, curbs and sidewalks.
3. Section 32 1723 - Pavement Markings: Painted pavement markings.

1.2 REFERENCES

A. Asphalt Institute (AI):
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
2. AI MS-3 - Asphalt Plant Manual.
3. AI MS-8 - Asphalt Paving Manual.
4. AI MS-19 - Basic Asphalt Emulsion Manual.

B. American Society for Testing and Materials (ASTM):
1. ASTM D 242 - Specification for Mineral Fiber for Bituminous Paving Mixtures.
2. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound Rammer and 12 inch Drop.
3. ASTM D 1188 - Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
4. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
5. ASTM D 1560 - Test Method for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
6. ASTM D 2397 - Specification for Cationic Emulsified Asphalt.
7. ASTM D 2399 - Practice for Selection of Cutback Asphalt.
8. ASTM D 2726 - Test Method for Bulk Specific Gravity and Density of Nonabsorbative Compacted Bituminous Mixtures.
9. ASTM D 3381 - Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
10. ASTM D 3549 - Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
11. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T 88 - Particle Size Analysis of Soils.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Provide asphalt-aggregate mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet standard state highway specifications and exhibit satisfactory records of previous installations.

1.4 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Assurance/Control Submittals:
      a. Design Data:
         1) Submit design mix following format indicated Asphalt Institute Manual MS-2, Marshall Stability Method; including type/name of mix, gradation analysis, grade of asphalt cement used, Marshall Stability (pounds), flow, effective asphalt content (percent), and direct references to applicable state highway department specification sections for each material.
         2) Provide design mixture listed in current edition of applicable state highway department specifications.
         3) Use mix designs prepared within 3 years maximum.
         4) Provide documentation of state highway limitations, if any, on use of recycled content materials.
      b. Certificates: Submit materials certificate to Testing Laboratory signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements specified herein.
      c. Qualification Documentation: Paving installer documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AI MS-8

B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

C. Regulatory Requirements:
   1. Conform to applicable requirements for paving work on public property.
   2. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Use temporary striping, flagmen, barricades, warning signs, and warning lights as required.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Jobsite Requirements:
   1. Apply prime and tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.
   2. Construct bituminous concrete paving when atmospheric temperature is above 40 degrees F.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Resource Management:

1. Recycled Content: Provide aggregate fabricated from a minimum of 30% recycled rubble or concrete. Provide asphalt cement fabricated from recycled content asphalt.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course: As indicated on Drawings, complying with applicable state highway specifications regarding source, quality, gradation, liquid limit, plasticity index and mix proportioning.
1. Unless otherwise specified in applicable state highway specifications, provide base course aggregate fabricated from minimum 30 percent recycled rubble or concrete.

B. Asphalt Cement: Fabricated from minimum 15 percent recycled asphalt and complying with ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, viscosity grade, depending on local mean annual air temperature as indicated below:

TEMPERATURE CONDITION	ASPHALT GRADES
Cold, mean annual air temperature at 45 degrees F or lower	AC-10 85/100 pen.
Warm, mean annual air temperature between 45 degrees F and 75 degrees F	AC-20 60/70 pen.
Hot, mean annual air temperature at 75 degrees F or higher	AC-30

C. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either ASTM D 2397 or ASTM D 2399, MC- 30 or SS-1h.

D. Tack Coat: Emulsified asphalt; ASTM D 2397 or ASTM D 2399, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D 242, if recommended by applicable state highway department standards.

F. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 pounds with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

G. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on CALTRANS AR4000. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
1/2 inch	80 - 100	5
3/8 inch	65 - 93	4
No. 8	0 - 55	4
No. 50	2 - 27	2
No. 200	0 - 10	2

Percent Bitumen by Weight of Total Mix: 5.0 - 8.5.
Percent Air Voids: 3-6.
Percent Aggregate Voids Filled with Asphalt Cement: 70 - 82.
Allowable Variance of Percent Bitumen by Weight of Total Mix: 0.4.

2.2 EQUIPMENT

A. Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
   1. Verify gradients and elevations of base are correct, and base is dry.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 BASE COURSE PLACEMENT

A. Perform base course construction in a manner that will drain surface properly at all times and at the same time prevent runoff from adjacent areas from draining onto base course construction.

B. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557, unless otherwise indicated on the Drawings.

C. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 8 inches, measured loose.

D. Sand/Shell Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4 inches, measured loose.

E. Asphalt Institute Type IV Mix for Full Depth Asphalt Base: Construct to thickness indicated on Drawings in lifts or layers not exceeding 3 inches, measured loose.

F. Asphalt Institute Type VI, VII, or VIII Mixes for Hot-Mix Sand Asphalt Bases: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 3 inches, measured loose.

G. Soil Cement Stabilized Base: Construct to thickness and strength as indicated on Drawings and in accordance with applicable state highway specifications. If not indicated on the Drawings, the minimum compressive strength shall be 500 pounds per square inch, tested at 28 days.

3.3 APPLICATIONS

A. Prime Coat:
   1. Apply bituminous prime coat to all base material surfaces where bituminous concrete paving will be constructed.
   2. Apply bituminous prime coat in accordance with applicable state highway specifications.
   3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.
   4. Make necessary precautions to protect adjacent areas from overspray.
   5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:
   1. Apply to contact surfaces of previously constructed bituminous concrete base courses or portland cement concrete and surfaces abutting or projecting into bituminous concrete or into bituminous concrete pavement.
   2. Apply tack coat to bituminous concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth bituminous concrete and sand asphalt bases and on surface of all such bases where bituminous concrete paving will be constructed.
   3. Apply emulsified asphalt tack coat in accordance with applicable state highway specifications.
   4. Apply at minimum rate of 0.05 gallon per square yard of surface.
   5. Allow to dry until at proper condition to receive paving.

3.4 BITUMINOUS CONCRETE PLACEMENT

A. Place bituminous concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
   1. When ambient temperature is between 40 degrees F and 50 degrees F, mixture temperature equal to 285 degrees F.
   2. When ambient temperature is between 50 degrees F and 60 degrees F, mixture temperature equal to 280 degrees F.
   3. When ambient temperature is higher than 60 degrees F, mixture temperature equal to 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster that they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of bituminous concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10 feet wide.

D. Joints: Make joints between old and new pavements, or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of bituminous concrete course. Clean contact surfaces of all joints and apply tack coat.

3.5 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 CONSTRUCTION

A. Site Tolerances:
   1. Paving Surface Smoothness: Maximum allowable 10 foot straightedge tolerance for smoothness.
      a. Base Course Surface: 1/4 inch.
      b. Wearing Surface Course: 3/16 inch.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection and testing procedures

B. Site Tests:
   1. Paving Base Course: Perform testing of in-place base courses for compliance with requirements for thickness, compaction, density, and tolerance.
      a. Moisture/Density Test: ASTM D 698 or ASTM D 1557.
      b. Mechanical Analysis Test: AASHTO T-88.
      c. Plasticity Index Test: ASTM D 4318.
      d. Base Material Thickness Test: Minimum one test for every 20,000 square feet.
      e. Base Material Compaction Test: Minimum one test for every 20,000 square feet.
      f. Field Density Tests: Perform testing of in-place base courses for compliance with requirements for density using one of the following methods:
         1) Sand-cone Method: ASTM D 1556.
         2) Balloon Method: ASTM D 2167.
         3) Nuclear Method: ASTM D 2922, Method B (Direct Transmission).
      g. Test each source of base material for compliance with applicable state highway specifications.

2. Asphalt Concrete Paving: Perform testing of in-place asphalt concrete paving courses for compliance with requirements for thickness, compaction, and surface smoothness.
   a. Thickness: ASTM D 3549; Thickness shall not be less than thickness specified on Drawings.
   b. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt paving course using 10 foot straightedge applied parallel with, and at right angles to centerline of paved areas. Smoothness shall not be less than tolerances specified herein.
3. Compaction: Field density test for in place materials shall be performed by examination of field cores in accordance with one of the following standards:
   a. Bulk Specific Gravity of Paraffin-Coated Specimens: ASTM D 1188, minimum one core per 20,000 square feet.
      1) Standard Duty Areas: Minimum 3 cores.
      2) Heavy Duty Areas: Minimum 3 cores.
   b. Bulk Specific Gravity Using Saturated Surface-Dry Specimens: ASTM D 2726, minimum one core per 20,000 square feet.
      1) Standard Duty Areas: Minimum 3 cores.
      2) Heavy Duty Areas: Minimum 3 cores.

END OF SECTION

SECTION 32 1313

CONCRETE PAVING

A. Section Includes:
   1. Concrete Pavement
   2. Concrete walks and terraces.
   3. Concrete curbs, and curb and gutters.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 31 2000 - Earth Moving: Earthwork for pavement.
   2. Section 32 1216 - Asphalt Paving.
   3. Section 03 3000 - Cast-In-Place Concrete: Concrete requirements for pavement.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 308 - Standard Practice for Curing Concrete.

B. American society for Testing and Materials (ASTM):
   1. ASTM A 185 - Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
   2. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
   4. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   5. ASTM D 1751 - Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.3 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Submit product data for the following:
      a. Joint filler.
      b. Joint sealant.
      c. Concrete admixtures.
      d. Concrete curing compounds.
   2. Assurance/Control Submittals:
      a. Concrete Mix Design: Submit three copies of each proposed mix design for each class of concrete in accordance with ACI 301, Sections 3.9 "Proportioning on the basis of previous field experience or trial mixture", or 3.10 "Proportioning based on empirical data". Submit separate mix design for concrete to be placed by pumping, in addition to the mix design for concrete to be placed directly from the truck chute.
      b. Include the following information in concrete mix design:
         1) Proportions of cement, fine and coarse aggregate, and water.
         2) Water-cement ratio, 28-day compressive design strength, slump, and air content.
         3) Type of cement and aggregate.
         4) Aggregate gradation.
         5) Type and dosage of admixtures.
         6) Special requirements for pumping.
         7) Range of ambient temperature and humidity for which design is valid.

8) Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Conform to ACI 305R when mixing and placing concrete during hot weather.

C. Conform to ACI 306R when mixing and placing concrete during cold weather.

D. Regulatory Requirements:
1. Conform to applicable requirements for paving work on public property.
2. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 FORM AND REINFORCING MATERIAL

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required.
1. APA Exterior Plyform BB with a medium density, smooth, hard, fused resin fiber overlay, or metal forms.
2. Form Oil: Coat forms with nonstaining type coating that will not discolor or deface surface of concrete. Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
   a. "Eucoslip" - Euclid Chemical Co., Cleveland, OH (800) 321-7628.
   b. "Form Coating" - Nox-Crete Chemicals, Omaha, NE (800) 669-2738.
   c. Substitutions: Under provisions of Section 016000.

B. Curb, Curb and Gutter Forms: Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

C. Reinforcing:
1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
2. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.
3. Fiber reinforced concrete mixtures having the same strength or exceeding as specified for concrete mixes, as verified by Manufacturer’s testing laboratory procedures, shall be considered as an alternate for welded wire mesh in exterior flat work, curbs and sidewalks.

D. Reinforcing Accessories:
1. Reinforcing Accessories: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
   a. Dayton Superior Corp., Miamisburg, OH (800) 745-3700.
   b. Heckmann Building Products, Inc., Chicago, IL (800) 621-4140.
   c. Hohmann & Barnard, Inc., Hauppauge, NY (800) 645-0616.
   d. Richmond Screw Anchor Co., Inc., Ft. Worth, TX (817) 284-4981.

2. Conform to Concrete Reinforcing Steel Institute Manual of Standard Practice. Include spacers and chairs with plastic tipped legs, ties and other devices necessary for properly assembling, placing, spacing and supporting forms and reinforcement in place.
3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

A. Comply with requirements of applicable Section 03 3000 for concrete materials, admixtures, bonding materials, curing materials, surface sealers and others as required.

B. Cement:
1. Portland Cement: ASTM C150 Type 1.
2. High-early Strength Portland Cement: ASTM C150, Type III.

C. Aggregates: ASTM C33.
1. Fine aggregate shall be natural sand, or sand prepared from stone or gravel. Grains shall; be clean, hard, durable, uncoated and free from silt, loam and clay.
2. Coarse Aggregates: Crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces free from adherent coatings. Maximum size of pieces shall be 3/4" to #4 except for footings, which may be 1-1/2". The maximum size of aggregate may also be not larger than one fifth of the narrowest dimension between forms, nor larger than three fourths of the minimum clear spacing between reinforcing bars.

D. Water: Clean and free from injurious amounts of oil, acids, salts, organic or other deleterious matter.

E. Air Entrainment: ASTM C260.
1. Use air-entrained concrete for exterior exposed concrete including walls, walks, paving, etc. where minimum daily temperatures are expected below 38 degrees F during pouring or subsequent 38 day curing period.
2. Proportion air-entraining concrete to attain minimum 28-day compressive strength specified.
3. Total Air Entrainment in Concrete: Not less than four percent nor more than six percent volume of concrete.

F. Admixtures:
1. May be used at contractors option to provide workability at low slumps, increased compressive strength, retardation or acceleration of the concrete.
2. Chemical Admixtures: ASTM C494. Mineral Admixtures: ASTM C618.
3. The cement factor shall not be reduced and changes shall be made in the other mix proportions to ensure the minimum strength requirements.
4. Use of admixtures approved in writing by Architect. No additional expense to the Owner will be allowed.
5. No calcium chloride shall be used.
6. Before any admixture is accepted for use, the Contractor shall submit certified laboratory reports on each additive material to the architectural consultant. The report shall show the following:
    a. Confirmation of compliance with the applicable ASTM Standard.
    b. Evaluation of the effects of the admixture on the properties of the concrete to be made on the job, including consideration of the anticipated ambient conditions on the job, and proposed construction procedures.
    c. Determination of within-lot uniformity of product proposed for use.

2.3 CONCRETE MIXES

A. Concrete Proportions:
   1. Concrete shall be homogenous, and when hardened, shall have the required strength, resistance to deterioration, durability, water tightness and the properties as specified.
   2. Minimum concrete strength at 28 days shall be;
      a. 3,000 psi for walks, terraces, curbs and gutters.
      b. 4,000 psi for concrete pavement and pads.
   3. Slump of concrete:
      a. Pavement: 2-1/2 inch minimum to 4 inch maximum.
      b. Ramps and sloping surfaces: Not more than 3 inches.

B. Ready-Mix Concrete:
   1. Ready-mix concrete shall conform to ASTM C94. The mixing agitation shall begin within 30 minutes, and the concrete shall be discharged from the truck within one hour after the water has been added to the concrete mix.
   2. Delivery tickets are to accompany each concrete truck and shall be kept in the job superintendent's file. Delivery tickets must indicate the following information or be subject to rejection:
      a. Name of project.
      b. Supplier of concrete.
      c. Truck identity and ticket serial number.
      d. Date of delivery.
      e. Brand of cement.
      f. Cement content.
      g. Strength classification.
      h. Batching time.
      i. Point of deposit.
      j. Total amount of water.
      k. Weight of aggregate.
      l. Daily temperature.
      m. Number of cubic yards in load.
      n. Admixture content.
      o. Name of Contractor.
      p. Name of driver.
      q. Time loaded and first mixing of concrete.
      r. Reading of revolution counter.
   3. Quantity of water used for each batch shall be accurately measured.

2.4 JOINT MATERIALS

A. Sealed expansion and contraction joints: Filler of nonbituminous rubber or cork conforming to ASTM D1752.

B. Non-sealed joints:
   1. Non-sealed Joints: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
      a. "Flexcell" - Celotex Corp., Tampa, FL (813) 873-1700.
      b. "Seal Tight Fiber Expansion Joint" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
   2. Filler premolded bituminous type conforming to ASTM D1751.
   3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

C. Noncompressive Filler:
   1. Noncompressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
      a. "Styrofoam SM" - Dow Chemical Co., Midland, MI (517) 636-0754.

b. "Foamular" - Owens Corning, Toledo, OH (800) 828-7155.
2. 2 inch or 1 inch thick sheets.
3. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

D. Compressive Filler:
1. Compressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
a. "Ethafoam" - Dow Chemical Co., Midland, MI (800) 322-8723.
b. "Rodofoam No. 423" - Sternson Group, Brampton, ON (800) 265-8417.
2. 2 inch or 1 inch thick sheets, compression modulus within the range of 15 to 25 pounds per square inch per inch.
3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

E. Filler Adhesive for Noncompressive Filler and Compressive Filler:
1. Filler Adhesive: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
a. "General Purpose Mastic No. 11" - Dow Chemical Co., Midland, MI (800) 322-8723.
b. "Rodofast" - Sternson Group, Brampton, ON (800) 265-8417.
2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

F. Slab-on-grade Construction Joints: Provide a full slab depth 24 gauge metal preshaped key, approximate depth of key to be 1/4 slab thickness and a key width of about 1/10 slab thickness.

G. Joint Sealants: ASTM C920. Non-priming, pourable, self-leveling polyurethane. Subject to compliance with project requirements manufacturers offering joint sealants which may be incorporated in the Work include, but are not limited to the following:
1. Sonolastic Paving Joint Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
2. Sonomeric CT 1 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
3. Sonomeric CT 2 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
4. Vulkem 45, by Mameco, Cleveland, OH (800) 321-6412.
5. Chem-Caulk, by Bostik, Middleton, MA (800) 726-7845.
6. "THC-900" - Tremco, Beachwood, OH (800) 562-2728.
7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.5 CURING MATERIALS

A. Sealers:
1. Sealers: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
a. "Polyseal" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
b. "Kure-N-Seal" - Sonneborn, Shakopee, MN (800) 433-9517.
c. "Cure-Hard" - W.R. Meadows, Inc., Elgin, IL (312) 683-4500.
2. ASTM C156 and ASTM C309, Type I. Material shall become integral part of concrete and leave slab free of residue or film.
3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Membrane: Opaque-white polyethylene sheet, 0.006 inch thick, meeting requirements of ASTM C171.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
   1. Verify gradients and elevations of base are correct, and base is dry.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 SUBGRADE PREPARATION

A. Conform with the requirements specified in Section 312000 .

B. Thoroughly wet subgrade and then compact with two passes of a 500 pound roller.

C. Pumping: Where concrete paving or sidewalks, and curbs are to be placed, yielding material deflecting more than 1/2 inch under a 500 lb. roller shall be removed to a depth of not less than 4 inches below subgrade elevation and replaced with an approved granular material which shall then be compacted as described above.

D. The subgrade shall be in a moist condition when the concrete is placed. In cold weather the subgrade shall be prepared and protected so as to provide a subgrade free from frost when the concrete is deposited.

3.3 FORM CONSTRUCTION

A. Comply with the requirements of Section 033000. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check complete formwork for grade and alignment to the following tolerances:
   1. Top of form: Not more than 1/8 inch in 10 feet.
   2. Vertical face: Longitudinal axis not more than 1/4 inch in 10 feet.

3.4 PLACING REINFORCEMENT

A. Support reinforcing and wire securely together to prevent displacement by construction loads and traffic, or the placing of concrete. For slabs on grade, supporting pieces of concrete blocks or bricks may be used.

B. Place wire mesh reinforcing two inches above bottom of slab unless otherwise indicated.

C. Reinforcement shall be kept clean from oil, dirt and loose mill scale or other coatings which might destroy the concrete bond. Remove tags and markings prior to concrete placement.

D. Do not place concrete until reinforcement has been inspected and approved by local authorities, if required.

3.5 CONCRETE PLACEMENT AND FINISHING

A. Tamp and consolidate concrete with a suitable wood or metal tamping bar and the surface shall be finished to grade with a wood float.

B. Finished surfaces shall not vary more than 3/16 inch from the testing edge of a 10 foot straightedge.

C. Curb Expansion Joints: Fill joints with 1/2 inch thick joint filler strips conforming to ASTM D1751 or ASTM D1752.

D. Contraction Joints: Divide the surface of paving, walks and terraces into rectangular areas not to exceed 5 feet 0 inches each way.
   1. Cut a groove in the top portion of the slab to a depth of at least one-fourth of the slab thickness using a jointer or by sawing a groove in the hardened concrete with a power-driven saw.
   2. Membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry.

E. Slab Finishes: ACI 301, paragraph 11.7 and as follows:
   1. Broom Finish: On stair treads with abrasive nosings and on walks, unless other finishes have been indicated or specified.
   2. Broom or Belt Finish: On level walks. Broom in direction perpendicular to travel and approved sample panel. Submit joint pattern layout prior to starting work.

3.6 TOLERANCES

A. Horizontal slabs: Finished surfaces true with no deviation in excess of 1/8 inch when tested with a 10 foot straightedge, non-accumulative. No coarse aggregate showing.

B. Steps:
   1. Variation in steps within a flight of stairs:
      a. Rise: 1/8 inch.
      b. Tread: 1/4 inch.
   2. Variation in consecutive steps:
      a. Rise: 1/16 inch.
      b. Tread: 1/8 inch.

3.7 EXPANSION JOINTS

A. Install transverse expansion joints at returns and 15 feet on center.

B. Install longitudinal expansion joints where curbs and paved areas abut each other, buildings, other concrete slabs and pads or vertical restraints.

C. Place joint filler with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.

D. Immediately after finishing operations are completed, round joint edges with edging tool having a radius of 1/8 inch. Remove concrete over the joint filler.

E. At the end of the curing period, clean and fill expansion joints with joint sealer. Fill joints flush with concrete surface. Dummy groove joints shall not be sealed.

3.8 CURING

A. Immediately after the finishing operations, the exposed concrete surface shall be cured for 7 days by the mat, impervious sheet, or membrane-curing method.

3.9 BACKFILLING

A. After curing, remove debris and backfill the adjoining areas, grade and compact to conform to the surrounding area in accordance with the lines and grades indicated.

3.10 PROTECTION

A. Protect the completed work from damage. Repair damaged concrete and clean concrete discolored during construction. Remove work that is damaged and reconstruct to entire length between regularly scheduled joints. Refinishing damaged portion is not acceptable.

B. Prevent cars and trucks from driving on new pavement for a minimum of 14 days.

END OF SECTION

SECTION 321723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Painted pavement markings.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 32 1216 - Asphalt Paving: Asphalt paving substrate for marking application.
   2. Section 32 1313 - Concrete Paving: Concrete paving substrate for marking application.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content for each paint type specified.
   2. Assurance/Control Submittals:
      a. Certificates: Manufacturer certificate that Products meet or exceed specified requirements.
      b. Test Reports: Manufacturer Material Safety Data Sheets (MSDS) for each paint type specified.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Provide paint materials that conform to Federal, State, and local restrictions for Volatile Organic Compounds (VOC) and lead-free content.

1.4 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

1.6 MAINTENANCE

A. Section 01 7704 – Closeout Procedures and Training: Requirements for Closeout Submittals.
   1. Extra Materials:
      a. Provide 1 gallon of each color to General Services Director or Designee.
      b. Label each container with color and type, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering specified Products which may be incorporated into the Work include the following:
   1. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.
   2. Benjamin Moore and Company, Montvale, NJ (201) 573-9600.
   3. Pittsburgh Paints (PPG), Pittsburgh, PA (800) 441-9695.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture providing good flowing and brushing properties capable of drying or curing free of streaks or sags. Dry to traffic and touch in 2 hours.

B. Traffic Paint: Flat, Water Base, Acrylic, complying with Federal Specifications TT-P 1952D
   1. 1st Coat:
      a. Sherwin-Williams: Pro-Park Waterborne Traffic Marking Paint, B97 Series MDF 9 mils.
      b. Benjamin Moore: SuperSpec HP Safety & Zone Marking Paint P58, MDF 9 mils
      c. PPG Zoneline Traffic & Marking Paint, 11-50 Series, MDF 9 mils.

   2. 2nd Coat:
      a. Sherwin-Williams: Pro-Park Waterborne Traffic Marking Paint, B97 Series MDF 9 mils.
      b. Benjamin Moore: SuperSpec HP Safety & Zone Marking Paint P58, MDF 9 mils
      c. PPG Zoneline Traffic & Marking Paint, 11-50 Series, MDF 9 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

A. Sweep pavement and surfaces to receive paint markings clean of dust and dirt. Allow pavement to cure a minimum of 60 days prior to application of paint markings.

B. Clean surfaces free of glaze and grease, road film, and other foreign materials.

C. Where existing pavement markings are indicated on Drawings to be removed or would interfere with the adhesion of new paint, use a motorized abrasive device to remove existing markings.
   1. Use equipment that will not damage existing paving or create surface hazardous to vehicle or pedestrian traffic.
   2. Use marking removal methods approved by governing authority having jurisdiction in areas within public rights-of-way.

3.3 APPLICATION

A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.

B. Do not apply paint markings on surfaces that are not dry and if rain is expected within 24 hours.

C. Do not apply paint markings when surface or air temperature is below 50 degrees F.

D. Apply 2 coats at manufacturer recommended rate without addition of thinner. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to provide uniform, clean, and straight stripe.

3.4 PAINT MARKING SCHEDULE

A. Paint the following items with colors indicated below:
   1. Pedestrian Crosswalks (Not Used).
   2. Fire Lanes: (Not Used).
   3. Lane Striping Where Separating Traffic in Opposite Directions (Not Used).
   4. Lane Striping Where Separating Traffic in Same Direction (Not Used).
   5. Accessible Parking Symbols: Blue and white as shown on plans.
   6. Parking Stall Striping: Blue and white as shown on plans.

END OF SECTION

SECTION 32 1726

TACTILE WARNING SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast in Place detectable warning tiles.
2. Cast in Place replaceable detectable warning tiles.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 32 1313 – Site Concrete Work.

1.02 PROJECT REQUIREMENTS

A. Regulatory Requirements: Comply with CBC requirements for design and installation.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating all pertinent characteristics, including profile, sound-on-cane contact amplification feature, and installation methods.

B. Product Data: Submit manufacturer's catalog data for each product proposed for installation.

C. Material Test Reports:

1. Submit current test reports from qualified, accredited independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and the meet properties indicated.

D. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1. Maintenance Instructions: Include copies of manufacturer's specified maintenance practices for each type of tactile warning surface tiles and accessories.

1.04 QUALITY ASSURANCE

A. Comply with following as a minimum requirement:

1. ASTM Test Methods B 117, C 501, C 1028, D 543, D 570, D638, D685, D790, G 151, G155, and E84

2. 2013 California Building Code, Seciton 11B-406 “Curb Ramps, Blended Transitions and Islands” and Section 11B-705 “Detectable Warnings and Detectable Directional Texture”.

B. Qualifications: Experienced installer, certified in writing by tactile warning surface manufacturer, who has successfully completed tactile warning surface installations similar in material, design, and extent to work in project.

1.05 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excessive moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.06 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials within specified warranty period.

1. Warranty includes: manufacturing defects, breakage, and deformation.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities [ICC A117.1] for tactile warning surfaces.

3. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

2.02 PERFORMANCE REQUIREMENTS

B. Compliance: Tactile Warning Tiles.

1. Compliant with ADAAG, PROWAG, and CBC Title 24 requirements.
2. Compliant with Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11).

C. Test Criteria: Meet or exceed the following test criteria, using the most current test methods.

1. Water Absorption: Not to exceed 0.20 percent, when tested in accordance with ASTM D 570.
2. Slip Resistance: 0.80 minimum combined wet/dry static coefficient of friction, when tested in accordance with ASTM D 695.
3. Compressive Strength: 25,000 psi minimum, when tested in accordance with ASTM C 1028.
4. Tensile Strength: 10,000 psi minimum, when tested in accordance with ASTM D 638.
5. Flexural Strength: 25,000 psi minimum, when tested in accordance with ASTM D 790.
6. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, and antifreeze, when tested in accordance with ASTM D 543.
7. Abrasion Resistance: 300 minimum, when tested in accordance with ASTM C 501.
8. Flame Spread: 25 maximum, when tested in accordance with ASTM E 84.
9. Accelerated Weathering: ΔE less than 5.0 at 2,000 hours minimum exposure, when tested by ASTM G 155 or ASTM G 151.
10. AASTHO_H20 Load Bearing Test: No damage at 16,000 pounds loading.
11. Salt and Spray Performance: No deterioration or other defects after 200 hour of exposure, when tested in accordance with ASTM B 117.

2.03 DETECTABLE WARNING TILES

A. Cast in Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, ramps, or new construction with slip-resistant surface treatment on domes and field of tile. Cast in Place Tiles have a 1/4 inch nominal thickness and feature embedment ribs 3 inches on center through entire length of tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ADA Solutions, Inc.; Cast in Place Detectable Warning Tile or comparable product by one of the following:

    a. Armorcast Products Co.
    b. Detectile, Inc.
    c. Or Equal.

2. Material: Homogeneous glass and carbon composite material which is colorfast and UV stable.
3. Color: Uniform throughout, and not reliant on any type of paint coating to achieve color stability. Federal Yellow (Y) per Federal Standard 595B Table IV, Color No. 33538. Verify shapes and sizes available from manufacturers.

4. Shapes and Sizes:
    a. Rectangular panel, 2.35 inch dome spacing: [24 by 36 inches] [24 by 48 inches] [24 by 60 inches] [36 by 48 inches] [36 by 60 inches], field verify size.

5. Mounting:

    a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

B. Cast in Place Replaceable Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, ramps, or new construction applications, shall have slip-resistant surface treatment on domes and field of tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ADA Solutions, Inc.; Cast in Place Replaceable Detectable Warning Tile or comparable product by one of the following:

    a. Armorcast Products Co.
    b. Detectile, Inc.
    a. Or Equal.

2. Material: Homogeneous glass and carbon composite which is colorfast and UV stable.
3. Color: Uniform throughout, and not reliant on any type of paint coating to achieve color stability. Federal Yellow (Y) per Federal Standard 595B Table IV, Color No. 33538.

4. Shapes and Sizes:

    a. Rectangular panel, 2.35 inch dome spacing: [24 by 36 inches] [24 by 48 inches] [24 by 60 inches] [36 by 48 inches] [36 by 60 inches], field verify size.

5. Mounting:

    a. Replaceable, fully assembled, detectable warning tile wet-set into freshly poured concrete.

2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

    1. Furnish color appropriate nylon sleeve, stainless-steel fasteners for exterior use.
    2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to substrate.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that concrete is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

3.02 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated in contract documents.

3.03 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast in Place Detectable Warning Tiles:

1. Concrete Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Tile Installation in new concrete: Follow manufacturer's detailed installation guidelines.
3. To the maximum extent possible, the Cast in Place Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple Cast in Place Tiles regardless of size are used, the truncated domes shall be aligned between the tactile warning surface Tiles and throughout the entire tactile warning surface installation.
4. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board): Sections 304 + 305), Tactile Warning Surface Tile shall be located relative to the curb line as shown within Sections 304+305 of the Guidelines.
5. Cast in Place Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Cast in Place Tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
6. Tiles shall be cut into size and configuration indicated on the Drawings using a 60 tooth carbide blade on a table saw or equivalent cutting device. Minimize any cantilever effect (to the maximum extent practicable) when cutting between successive embedment ribs as concrete will tend to flow up and over the Cast in Place Tiles. The top of the body of the Cast in Place Tiles shall be fully seated and flush with the adjacent concrete substrate. For specific instructions for cutting and setting refer to Tactile Warning Surface manufacturer’s written instructions.
7. Clean tiles using methods recommended in writing by manufacturer.

B. Cast in Place Replaceable Detectable Warning Tiles:

1. Concrete Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.
2. Tile Installation: Follow manufacturer's detailed installation guidelines.
3. To the maximum extent possible, the Cast in Place Replaceable Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple Cast in Place Replaceable Tiles regardless of size are used,

the truncated domes shall be aligned between the tactile warning surface tiles and throughout the entire tactile warning surface installation.

4. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board): Sections 304 + 305), Tactile Warning Surface Tile shall be located relative to the curb line as shown within Sections 304+305 of the Guidelines.
5. The Cast in Place Replaceable Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Tactile Warning Surface Tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
6. On Continuous Runs: The Installer shall leave a 3/16" nominal gap between successive Tactile Warning Surface Tiles. As part of the concrete finishing operation, the Installer shall apply 1/8 - 1/4 inch edge treatment around the perimeter of the Tactile Warning Surface Tiles to facilitate future replacement of the Tactile Warning Surface Tile. A Urethane Sealant such as Sikaflex 1a or BASF NP1 shall be applied to the edge treatment for a watertight Tactile Warning Surface Tile installation.
7. Clean tiles using methods recommended in writing by manufacturer.

3.04 CLEANING AND PROTECTION

A. Protect detectable warning tiles against damage during construction period to comply with tile manufacturer's specifications.

B. During and after the detectable warning tiles installation and the concrete curing stage, it is imperative that there are no walking, leaning, or external forces placed on the tile to rock the tile, causing a void between the underside of the tile and the concrete substrate.

C. Remove protective plastic sheeting from detectable warning tiles within 24 hours of installation.

D. Clean tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of the project.

END OF SECTION

SECTION 32 3114

SQUARE TUBE FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Square tube fence framework, fabric, and accessories.
   2. Excavation for post bases, concrete footings for posts, and center drop for gates.
   3. Square tube manual gates and related hardware.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 03 3000 - Cast-In-Place Concrete: Post footings.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 787 - Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing
   2. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   3. ASTM F 1184 - Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class
   4. ASTM A 123 - Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products.

B. Underwriter’s Laboratories (UL):
   1. UL325, Door, Drapery, Gate, Louver, Window Operators, and Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Submit product data for fabric, posts, accessories, fittings, and hardware.
   2. Shop Drawings: Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorage's, and schedule of components.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store, and protect products under provisions of Section 01 6000.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
   2. Anchor Fence Division, Master-Halco, Incorporated, Baltimore, MD (800) 229-5615.
   3. Merchant's Metals, Houston, TX (800) 254-0080.
   4. The Tymetal Corporation, Fort Miller, NY (518) 695-9000.

B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Steel Framing:

   1. HORIZONTAL RAILS - Rail members will be constructed of 1 ½" x ½" x 1/8" (11 gauge) cold rolled bar channel. Number of rails per-piece will vary by panel style. Rails will be punched for picket pass-through and welding from underneath.
   2. PICKETS: Material for the pickets will be ¾" x ¾" x 16 gauge square tubing.
   3. PICKET SPACING: Standard pickets will have a 3.875" air gap in-between.
   4. FINIALS: Finial tips will be 3" tall x 2" wide and pressed points.

B. Pedestrian Gates:

   1. FRAME: All walk gates will match fence panel styles and be framed with 2" x 2" x 14 gauge square tubing mitered and welded.
   2. HORIZONTAL RAILS - Rail members will be constructed of 1 ½" x ½" x 1/8" (11 gauge) cold rolled bar channel. Number of rails per-piece will vary by panel style. Rails will be punched for picket pass-through and welding from underneath.
   3. PICKETS: Material for the pickets will be ¾" x ¾" x 16 gauge square tubing.
   4. PICKET SPACING: Standard pickets will have a 3.875" air gap in-between.
   5. FINIALS: Finial tips will be 3" tall x 2" wide and pressed points.

C. Posts and Standard Hardware:

   1. STANDARD STEEL POSTS: All posts used for hanging fence panels and walks gates will be 14 gauge and offered in a 2", 2.5", 3" and 4" square tube size. Lengths include 5', 6', 7', 8', and 9' with availability varying by post diameter.
   2. STEEL FLANGE POSTS: Posts with a welded foot for mounting to surfaces will be 14 gauge and offered in a 2.5" square tube size. Lengths offered are 3', 4', 5 and 6'. Welded flange foot will be 5" square with a ½" hole in each corner for hardware.
   3. POST CAPS: All post caps are comprised of formed sheet metal.
   4. FENCE PANEL BRACKET: Brackets are comprised of steel. The bracket has a 1.5" wide x 1/2" tall x 1" deep inner diameter (ID) and a 1.875" wide x 1" tall x 1" deep outer diameter (OD). A 3/4" tab with opening for a #14 hex head screw hangs below the bottom.
   5. J-BOLT HINGES: Used for walk gates and drive gates. Offered in a 5" size (5/8" shank) for walk gates and 7" size (3/4" shank) for drive gates. Both sizes feature adjustable gate settings and installed grease zerks
   6. HINGE BOLT KIT: Comprised of stainless steels bolts, nuts and washers in various sizes to work with all hinge and post sizes.

7. SELF-TAPPING SCREWS: Used to secure panels to the post via bracket. Hex-head configuration and is sized 1" x #14. All screws are steel have an anodized black finish for rust inhibition.

2.3 MIXES

A. Footing Concrete: 3,000 psi Portland cement concrete.

B. Grout: Premixed, factory packaged, non staining, non corrosive grout. Provide type formulated for exterior application.

2.4 FABRICATION

A. Assemble gate frames rigidly by welding or with special fittings and rivets. Bars may also be used at top and bottom edges. Attach stretchers to frame at not more than 15 inches on center.

B. Attach hardware to provide security against removal or breakage.

2.5 FINISHES

A. All fence posts, panels, components, and accessories shall be galvanized, primed and painted to match existing fencing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 INSTALLATION

A. Install fence in accordance with ASTM F 567 and manufacturer's published instructions.

B. Install gates in accordance with ASTM F 900, ASTM F2200 or ASTM 1184 as applicable and to manufacturer's published instructions.

C. Space line posts 10 feet 0 inches on center maximum, unless otherwise indicated on Drawings.

D. Grade-set Posts:
   1. Drill or hand excavate.
   2. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post.
   3. Excavate approximately 3 inches lower than post bottom; set post bottom not less than 36 inches below finish grade.
   4. Hold post in position while placing, consolidating, and finishing concrete.

E. Sleeve-set Posts: Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with grout, mixed and placed to manufacturer's recommendations.

F. Rails: Run rail between post, bending smoothly for curved runs located at the bottom of the fence fabric. Provide expansion couplings as recommended by fencing manufacturer.

G. Brace Assemblies: Install braces so posts are plumb with rod in tension.

H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

I. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.3 CONSTRUCTION

A. Site Tolerances:
   1. Maximum Variation from Plumb: 1/4 inch.
   2. Maximum Offset from True Position: 1 inch.
   3. Locate fencing components completely within site boundaries. Do not infringe adjacent property lines.
   4. Maximum Fence Distance from Ground: 1 1/2 inches.
   5. Maximum Gate Distance from Ground: 4 inches.

3.4 FIELD QUALITY CONTROL

A. All anchor bolts shall be fully concealed in the finished installation.
B. Owner, or owner’s representative, shall complete “punch list” with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturers where applicable.

END OF SECTION

SECTION 32 9113

SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. pH Adjusters.
   2. Soil Conditioners.
   3. Fertilizer.
   4. Pesticides.
   5. Application of topsoil.
   6. Landscape grading.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
   1. Section 31 2000 - Earth Moving: Topsoil.
   2. Section 32 9200 - Turf and Grasses: Groundcover materials.
   3. Section 32 9300 - Plants: Plants, trees, and shrubs.

1.2 SUBMITTALS

A. Section 013300 - Submittal Requirements: Procedures for submittals.
   1. Product Data: Manufacturer's data including installation and storage instructions for each product specified.
   2. Assurance/Control Submittals:
      a. Pesticide Control Plan: Proposed sequence of pesticide work. Include common name, chemical composition, formulation, concentration, rate and method of application, for all products furnished; and names of state certified applicator(s), in the appropriate category.
      b. Test Reports: Topsoil composition, in duplicate.
      c. Certifications: In duplicate. Certify that topsoil, peat, lime, aluminum sulfate perlite and vermiculite conforms with requirements specified.
      d. Field Reports: Pesticide application, in duplicate.
      e. Qualification Documentation: Pesticide applicator documentation of experience indicating compliance with specified qualification requirements.

1.3 QUALITY ASSURANCE

A. Applicator Qualification: Applicator specializing in performing Work of this Section with minimum 5 years documented experience.
   1. Pesticide applicator; state certified, using procedures, materials and equipment of type required for Work.

B. Regulatory Requirements: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of the state in which the project is located.

1.4 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials to job site in unopened containers bearing manufacturer's name and content identification, Environmental Protection Agency (EPA) registration number and manufacturer's registered uses.

C. Store materials as recommended by manufacturer.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:
   1. Protection of Personnel Property: Apply pesticides so damage will not result to personnel or property from wither direct spray of drifting of chemicals both on and off site.
   2. Disposal of Excess Chemicals and Containers: In accordance with Federal, State laws and local rules and regulations.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Specified in Section 312000.

2.2 pH ADJUSTERS

A. Lime:
   1. Commercial grade ground, hydrated, or burnt limestone containing not less than 50 percent of total oxides, [_____] percent calcium and [_____] percent magnesium oxide.
   2. Gradation: Minimum 75 percent passing 100-mesh sieve and 100 percent passing 20-mesh sieve.

B. Ferrous Sulfate: Commercial grade.

2.3 SOIL CONDITIONERS

A. Use singly or in combinations required to meet requirements for topsoil.

B. Soil Conditioners: Nontoxic to plants.

C. Peat:
   1. Peat moss derived from a freshwater site and conforming to ASTM D 2607 as modified herein.
   2. Shred and granulate peat to pass 1/2 inch mesh screen and condition in storage pile for minimum six months after excavation.

D. Sand: Clean and free of materials harmful to plants.

E. Perlite: Horticultural grade for planters.

F. Vermiculite: Horticultural grade for planters.

G. Rotted Manure:
   1. Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of stones, sticks and soil.

H. Composted Wood Derivatives:
   1. Ground bark, sawdust, or other wood waste material free of stones, sticks, and soil stabilized with nitrogen having the following properties:
      a. Particle Size: Minimum percent by weight passing:
         1) No. 4 mesh screen 95 percent
         2) No. 8 mesh screen 80 percent
      b. Nitrogen Content: Minimum percent based on dry weight:
         1) Redwood Sawdust 0.5 percent
         2) Fir Sawdust 0.7 percent
         3) Fir or Pine Bark 1.0 percent

I. Calcined Clay:
   1. Granular particles produced from montmorillonite clay calcined to minimum temperature or 1200 degrees F to the following graduation:
      a. Minimum 90 percent passing 8-mesh screen.
      b. 99 percent retained on 60-mesh screen.
      c. Maximum 2 percent passing 100-mesh screen.
   2. Bulk Density: 40 pounds maximum per cubic foot.

2.4 FERTILIZER

A. Specified in Section 32 9200 and 32 9300.

2.5 PESTICIDES

A. Soil Fumigant, Herbicide: EPA registered and approved, for pre-emergence and broadleaf weed control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Subgrade:
   1. After areas required to be landscaped have been brought to required subgrade, thoroughly till to minimum depth of 6 inches by scarifying, disking, harrowing, or other approved methods.
   2. Remove debris and stones larger than one inch in any dimension remaining on surface after tillage.

3.3 TOPSOIL APPLICATION

A. Immediately prior to placing topsoil, scarify subgrade to a 2 inch depth for bonding of topsoil with subsoil.

B. Lawns: Spread topsoil evenly to a minimum depth of 4 inches. Do not spread topsoil when frozen or excessively wet or dry.

C. Plant Beds: Till to minimum depth of 6 inches. Spread peat uniformly over bed to minimum depth of 4 inches and thoroughly incorporate into existing soil to a minimum depth of 6 inches to obtain a uniform and well pulverized soil mix. During tillage operations remove all sticks, stones, roots, and other objectionable materials, Bring plant beds to a smooth and even surface conforming to established grades.

D. Plant Beds: Excavate existing soil in plant beds to minimum depth of 4 inches and replace with planting soil mixture. Bring plant beds to smooth and even surface conforming to established grades.

E. Correct irregularities in finished surfaces to eliminate depressions.

F. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.4 FERTILIZER, pH ADJUSTERS, AND SOIL CONDITIONERS

A. Application:
   1. Apply fertilizer, pH adjuster, and soil conditioner at rates and analysis determined by laboratory soil tests of soils at job site or topsoil supplied.
   2. Apply at rates of per manufacturer’s instructions

B. Tillage: Incorporate fertilizer, pH adjusters, and soil conditioners into soil to minimum depth of 6 inches. This may be done as part of the subgrade tillage operation specified above.

END OF SECTION

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SECTION 32 9200

TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Seed.
2. Sod.
3. Sprigs.
4. Mulches.
5. Asphalt Adhesive.
6. Water.
7. Erosion Control Material.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
1. Section 31 1000 - Site Clearing: Mulch from recycled site debris.
2. Section 31 2000 - Earth Moving: Topsoil material.
3. Section 31 3200 - Soil Stabilization: Stabilization materials and procedures.
4. Section 31 2500 - Erosion and Sedimentation Controls: Slope and erosion protection materials.
5. Section 32 9200 - Plants: Planting materials.

1.2 REFERENCES

A. American Society For Testing and Materials (ASTM):
1. ASTM C 602 - Specification for Agricultural Liming Materials.
2. ASTM D 977 - Specification for Emulsified Asphalt.

B. American Sod Producers Association (ASPA):
1. ASPA STSMT - Specification for Turfgrass Sod Materials and Transplanting/Installing.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Assurance/Control Submittals:
a. Certificates:
1) Submit certificate from seed supplier for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
2) Submit certificate from sod supplier for each seed mixture, identifying sod source, including name and telephone number of supplier.

B. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types of application frequency, and recommended coverage of fertilizer for one full growing cycle.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of the state in which the project is located.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Resource Management:
   1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
      a. Soil amendments: No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
      b. Mulch: Provide organic mulch products.
   2. Recycled Content:
      a. Wood fiber mulch: Provide products manufactured from 100 % post-consumer paper content and yard trimming composts.
      b. Mulch from recycled site debris: Coordinate with Section 31 1000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.
      c. Soil amendment from recycled scrap gypsum: Coordinate with Section 092900 - Gypsum Board to prepare scrap gypsum board for use as soil amendment.

PART 2 - PRODUCTS

2.1 SOD

A. Classification:
   1. Nursery grown, Field as classified in ASPA STSMT.
   2. Machine cut sod at a uniform thickness of 3/4 inch with a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece capable of supporting its own weight when lifted by ends.
   3. Broken pads, irregularly shaped pieces, torn or uneven ends will be rejected.
   4. Wood pegs and wire staples for anchorage as recommended by sod supplier.

2.2 SPRIGS

A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes, from 4 to 6 inches long, obtained from heavy and dense sod.
   1. Provide sprigs which have been grown under climatic conditions similar to those in locality of Project Site.
   2. Coordinate harvesting and planting operations to prevent exposure of sprigs to sun for more than 30 minutes before covering and moistening.
   3. Sprigs containing weeds or other detrimental material or that are heat damaged will be rejected.

2.3 MULCHES

A. Provide mulch free from noxious weeds, mold, and other deleterious materials.

B. Wood Cellulose Fiber:
   1. Processed to contain no growth or germination-inhibiting factors, dyed with non toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application.
   2. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0
   3. Use with hydraulic application of grass seed and fertilizer.
   4. Provide organic mulch products manufactured from 100 percent post-consumer paper content and yard trimming composts.
   5. Manufacturers:
      a. National Fiber, Belcher, MA, (800) 282-7711 or (413) 283-8747.
      b. Wood Recycling Inc., Woburn, MA, (800) 982-8732 or (617) 937-0855.
      c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.4 STABILIZING MATERIALS

A. Specified in Section 313200.

B. Asphalt Adhesive: ASTM D 977, Grade RS-1. Use with straw or hay mulch.

C. Cellulose Fiber: Use for anchoring straw. Fiber binding shall be applied at a net dry weight of 750 pounds per acre. Cellulose fiber may be mixed with water. Mixture shall contain maximum of 50 pounds of cellulose fiber per 100 gallons of water.

D. Mulch Netting: Stake light weight plastic netting over the mulch according to manufacturer's recommendations. Stakes shall be driven to ground level.

2.5 WATER

A. Suitable quality for irrigation.

2.6 EROSION CONTROL MATERIAL

A. Specified in Section 312500.

B. Net: Heavy, twisted jute mesh, plastic mesh, biodegradable paper fabric with knitted yarns, or standard weave burlap.

2.7 TOPSOIL

A. Topsoil:
   1. Containing organic matter as needed to support establishment of plants; minimum [__] percent and maximum [___] percent organic matter as determined by soil testing service. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen.
   2. Component Percentages:

a.	Silt:	25 to 50
b.	Clay:	10 to 30
c.	Sand:	20 to 30
d.	pH:	5.5 to 7.0
e.	Soluble Salts:	600 ppm maximum
f.	pH:	5.5 to 7.0.

2.8 pH ADJUSTERS

A. Lime:
   1. Material: ASTM C 602, Class T, agricultural commercial grade ground limestone containing not less than 50 percent of total oxides.
   2. Gradation: Minimum 75 percent passing 100 mesh sieve and 100 percent passing 20 mesh sieve.

B. Ferrous Sulfate: Commercial Grade.

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NOTE TO SPECIFIER

Edit FERTILIZER below for type of fertilizer appropriate for specific soil conditions at Project Site.

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2.9 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum 4 percent nitrogen and 20 percent phosphoric acid.

B. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorous, and potassium in the following composition:
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
   2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from qualified soil-testing agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Place topsoil as specified in Section 31 2000.

3.3 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's published instructions.

B. Apply after smooth after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

F. No chemical fertilizers.

3.4 SODDING

A. Placing:
1. Place a maximum of 20 hours after initial harvesting, in accordance with ASPA GSS as modified herein.
2. Thoroughly moisten areas to be sodded immediately prior to placing.

B. Spot Sodding:
1. Cut sod into plugs 2 inches square or 2 inches in diameter. Place individual pieces on centers and press firmly into soil by foot pressure or by tamping.
2. Overseed for erosion control on all spot sodded areas.
3. Place seed, as specified above, at the rate of 15 pounds per 1,000 square feet.

C. Slopes and Ditches:
1. For slopes 2:1 and greater, lay with long edge parallel to slope.
2. V-ditches and flat bottomed ditches, lay with long edge perpendicular to flow of water.
3. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center.
4. On slope areas, start sodding at bottom of slope.

D. Finishing: After completing sodding, blend edges of sodded area smoothly into surrounding area.

E. Watering: Start immediately after completing each day's sodding. Apply at a rate sufficient to ensure thorough wetting of soil to minimum depth of 4 inches.

3.5 CLEANING AND PROTECTION

F. Remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.

G. Immediately after seeding, sodding or sprigging, protect the area against traffic or other use.

H. Restore existing lawn and grass areas which have been damaged during execution of this work to original condition.

I. Keep one paved pedestrian access route and one paved vehicular access route to each building clean at all time. Clean other paving when work in adjacent areas is complete.

3.5 ESTABLISHMENT PERIOD

A. Definitions:
   1. Lawns and grasses establishment period will be in effect until lawns and grasses have been mowed 3 times.
   2. Stand of lawn and grass is 95 percent ground cover of established species.

B. Maintenance During Establishment Period:
   1. Mow lawns and grassed areas to an average height of 3 inches whenever average height of grass becomes 3 inches.
   2. Promotion of growth: Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other operations necessary to promote growth.
   3. Post-fertilize areas with commercial grade controlled release fertilizer approximately3 days after planting and at intervals of 4 weeks thereafter until accepted. Apply fertilizer uniformly at the rate per manufacturer’s instructions

3.6 FINAL INSPECTION AND ACCEPTANCE

A. Final Inspection and Acceptance:
   1. Final inspection will be made upon written request from the Contractor at least 10 days prior to last day of lawn and grasses establishment period.
   2. Final acceptance will be based upon a satisfactory stand of lawns and grasses as defined in the paragraph entitled, "Establishment Period." Prior to final acceptance apply of controlled release fertilizer.

B. Replanting: Replant areas which do not have a satisfactory stand of lawns and grasses.

C. Contractor is to maintain lawns and grasses for one year from completion.

END OF SECTION

SECTION 33 1100

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Domestic water system pipe and fittings.
   2. Connection of domestic water system to municipal water system.
   3. Fire protection water system pipe, fittings, valves, and hydrants.
   4. Connection of fire protection water system to municipal water system.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 312300 - Excavation and Fill: Earthwork for utilities.
   2. Section 033000 - Cast-In-Place Concrete: Concrete for thrust blocks.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society for Testing and Materials (ASTM):
   1. ASTM B 88 - Specification for Seamless Copper water Tube.
   2. ASTM D 1785 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   3. ASTM D 2241 - Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series).
   4. ASTM D 3034 - Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   5. ASTM D 3139 - Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

C. American Water Works Association (AWWA):
   1. AWWA C 110 - Gray-Iron Fittings, 3 inches Through 48 Inches, for Water and Other Liquids.
   2. AWWA C 111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. AWWA C 151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
   4. AWWA C 504 - Rubber Seated Butterfly Valves.
   5. AWWA C 509 - Resilient Seated Gate Valves 3 inch through 12 inch NPS, for Water and Sewage Systems.
   6. AWWA C 600 - Installation of Ductile-Iron Water Mains and Appurtenances.
   7. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   Product Data: Data for each type of pipe, pipe fitting, valve and accessory specified.
B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Project Record Documents: Accurately record the following:
      a. Locations of piping mains, valves, connections, and top of pipe elevations.
      b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Perform work in accordance with utility company requirements and local authority having jurisdiction requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3 inch that are installed below grade and outside building shall comply with one or combination of following:
   1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22.
   2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1785 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.

B. Pipe sizes 3 inch and larger that are installed below grade and outside building shall comply with one of the following:
   1. Ductile Iron Water Pipe: In accordance with AWWA C 151, Fittings shall be either mechanical joint or push-on joint complying with AWWA C 110 or AWWA C-111 (CLASS 50).
   2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150). Pipe shall be continually marked as for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.2 GATE VALVES - 2 Inches and Larger

A. Manufacturers: Mueller Resilient Seat Gate Valves.

B. AWWA C509, Iron body, bronze mounted double disc, parallel seat type, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Drawings, extension box and valve key.

C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.3 BALL VALVES - 2 Inches and Smaller

A. Manufacturers: Mueller Oriseal.

B. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.4 BUTTERFLY VALVES - 2 inches to 24 inches

A. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.5 CHECK VALVES, POST INDICATOR VALVES, AND BACKFLOW PREVENTORS

A. Specified in Section 210000 - Fire Suppression.

2.6 HYDRANTS

A. Hydrant: Type as required by utility company, local authority having jurisdiction, and as indicated on Drawings.

B. Hydrant Extensions: Provide in multiples of 6 inches with rod and coupling to increase barrel length.

C. Hose and Stream Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle. Provide connection type as required by local fire marshall and by governing agencies having jurisdiction.

D. Finish: Primer and two coats of enamel or special coating to color as required by utility company.

2.7 ACCESSORIES

A. Concrete for Thrust Blocks: Section 03 3000. Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90˚ Bend Sq. Ft.	45˚ Bend Sq. Ft.	22˚ Bend Sq. Ft.	11˚ Bend Sq. Ft.
3"	1.0	1.0	1.0	1.0	1.0

4"	1.0	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0	1.0
8"	2.5	3.5	1.8	1.0	1.0
10"	4.0	5.5	2.8	1.5	1.0
12"	6.0	8.0	4.0	2.0	1.5
14"	8.0	11.0	5.5	3.0	2.0
16"	10.0	14.2	7.0	4.0	3.0
18"	21.0	21.0	12.0	6.0	4.0

B. Locked Mechanical Joint fittings shall be installed where vertical changes in direction are required and, if approved by General Services Director or Designee, can be installed in lieu of the above thrust blocking requirements.

C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted in large letters.
   1. Domestic Water Lines: "DOMESTIC WATER SERVICE"
   2. Fire Protection Water Lines: "FIRE PROTECTION WATER SERVICE"

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. Cut pipe ends square, ream pipe and tube ends and remove burrs.

D. Remove scale and dirt, on inside and outside, before assembly.

E. Prepare pipe for connections to equipment with flanges or unions.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.

B. Form and place concrete for pipe thrust restraints at any change of pipe direction and at fittings as indicated on Drawings. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil per schedule on Drawings.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

E. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local code.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local utility company.

F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

G. Establish elevations of buried piping in accordance with Section 312300 for work in this Section.

H. Backfill trench in accordance with Section 312300.

I. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Drawings in vertical and plum position with stream/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and

barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

C. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

D. Paint hydrants in accordance with local utility company requirements.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts/million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part/million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA specifications. Do not place distribution system in service until approval is obtained from applicable governing authorities.

3.7 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with by-pass valves and sand strainer.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Site Tests:
   1. Compaction:
      a. Perform inspections prior to and immediately after placing bedding.
      b. Perform tests as specified in Section 31 2300.
   2. Piping: Water distribution system pipe installed below grade and outside building shall be tested in accordance with following procedures:
      a. Perform the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with Section 4 of AWWA C600 latest edition. In the event any state or local code requires a more stringent test, the more stringent shall apply.
      b. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure at the highest point along the test section.
      c. Leakage Test: The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time. No pipeline installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

L = allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D = nominal diameter of pipe, (inches)

P = average test pressure during test, (psig)

d. Visible Leakage: All visible leaks shall be repaired regardless of the amount of leakage.
e. Acceptance of Installation: If any test of pipe laid in place discloses leakage greater than that specified, the Contractor shall, at his own expense, locate the leak and make repairs as necessary until the leakage is within the specified allowance. Contractor shall supply all water for testing at no additional cost to City of Torrance.
f. Provide one copy of results of meter test and hydrostatic pressure test to General Services Director or Designee and utility company upon completion of water distribution backfilling operations.

END OF SECTION

SECTION 33 3000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer drainage piping, fittings, accessories and bedding.
2. Connection of project sanitary drainage system to the municipal sanitary sewer system.
3. Clean-out and access structures.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
1. Section 31 2300- Excavation and Fill: Earthwork for utilities.
2. Section 03 3000 - Cast-In-Place Concrete: Concrete for cleanout and manhole base pads.

1.2 REFERENCES

A. American Association of State Highway and transportation Officials (AASHTO):
1. AASHTO M294 - Corrugated Polyethylene Pipe, 300-1200 mm Diameter.
2. AASHTO M252 - Corrugated Polyethylene Drainage Pipe.

B. American National Standards Institute (ANSI):
1. ANSI A21.14 - Ductile Iron Fittings, 3-Inch Through 24-Inch, for Gas.

C. American Society for Testing and Materials (ASTM):
1. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
2. ASTM C 14 - Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C 425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
5. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
7. ASTM A 746 - Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and perforated.
9. ASTM F 477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Data for each type of pipe and pipe accessory specified.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following.
a. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Perform work in accordance with utility company requirements and applicable health codes and authority having jurisdiction requirements.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Polyvinyl Chloride (PVC) Pipe:
1. ASTM D 3034, Rated SDR 35 unless otherwise required by local utility having jurisdiction. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
2. ASTM D 3034, Table 2; pipe joints with integrally molded bell ends and factory supplied elastomeric gaskets and lubricant.

B. Vitrified Clay (VCP) Pipe:
1. Pipe: ASTM C 700.
2. Joints: ASTM C 425.
3. Gaskets: ASTM C 425; high grade vulcanized elastomeric compound consisting of basic natural or synthetic rubber. Provide gaskets manufactured in compliance with Rubber Manufacturer's Association tolerances for gaskets.
4. Lubricant: Suitable for lubricating joint components; no deteriorating effects on gasket or pipe material, will not support growth of fungi or bacteria, and of type recommended by gasket manufacturer.

C. Ductile Iron Pipe:
1. Pipe: ASTM A 746; Extra Heavy type, inside nominal diameter as indicated on Drawings with bell and spigot end.
2. Pipe Joint: ANSI A21.14, rubber gasket joint devices.

D. Concrete Pipe:
1. Pipe: ASTM C 14, Class 1, 2, or 3; bell and spigot pipe with inside nominal diameter as indicated on Drawings.
2. Pipe Joint: ASTM C 443; rubber compression gasket joint devices.

E. Reinforced Concrete Pipe:
1. Reinforced Concrete: ASTM C 76, Class I, II, III, IV, or V as indicated on Drawings, with Wall type A, B, or C; mesh reinforcement; inside nominal diameter as indicated with bell and spigot end.
2. Reinforced Concrete: ASTM C 443; rubber compression gasket joint devices.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted with "SEWER SERVICE" in large letters.

2.3 CLEANOUTS AND MANHOLES

A. Lid and Frame: Heavy duty cast iron with removable lid as indicated on Drawings.

B. Shaft Construction: Cast Iron shaft of internal diameter as indicated on Drawings with 2500 psi concrete collar for cleanouts.

C. Base Pad: Concrete specified in Section 033000.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, manufacturer's published instructions and state or local requirements. Seal joints watertight.

B. Install pipe on minimum 4 inch bedding as specified in Section 312300.

C. Lay pipe to slope gradients indicated on Drawings.

D. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.

E. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Drawings.

F. Install trace wire continuous over top of pipe buried 6 inches below finish grade, above pipe line.

3.5 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be placed at required elevations.

C. Mount lid and frame level in grout, secured to top section at elevation indicated.

3.6 SERVICE CONNECTIONS

A. Coordinate the Work with termination of sanitary sewer connection outside building including connection to municipal sanitary sewer system.

B. Connect to existing municipal sanitary sewer system in compliance with utility requirements for new service connections.

3.7 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field testing and inspection.

B. Site Tests:
   1. Perform inspections prior to and immediately after placing bedding.
   2. Compaction: Specified in Section 312300.
      a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
      b. Frequency of Tests: One test for each 50 lineal feet of trench.

3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
   a. Pressure Test.
   b. Infiltration Test
   c. Deflection Test

END OF SECTION

SECTION 33 4000

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site storm sewer drainage piping, fittings and accessories, and bedding.
   2. Connection of storm sewer system to municipal storm sewer system.
   3. Catch basins, paved area drainage, site surface drainage, and storm water detention facilities.

B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 31 2300 - Excavation and Fill: Earthwork for utilities.
   2. Section 33 3000 - Sanitary Sewerage Utilites: Site sanitary sewer system.
   3. Section 03 3000 - Cast-In-Place Concrete: Concrete for catch basins, inlets, and junction boxes.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 760 - Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
   2. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
   3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   4. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
   5. ASTM D 2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
   6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
   7. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to start of backfill operations.

1.4 SUBMITTALS

A. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Project Record Documents: Accurately record the following.
      a. Actual locations of pipe runs, connections, manholes, catch basins, cleanouts, and invert elevations.
      b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to local Public Works Standard Specifications for materials and installation of the work of this Section.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Reinforced Concrete Pipe:
   1. Pipe: ASTM C 76, Class III unless indicated otherwise on Drawings.
   2. Gaskets: ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.

B. Corrugated Steel Pipe:
   1. Pipe: ASTM A 760; galvanized, aluminized or bituminous coated round pipe, arch pipe, or slotted drain pipe as indicated on Drawings., 16 gage unless otherwise indicated.
      a. Provide slotted drain pipe with 1.75 inch wide drain guide waterway openings and 6 inch minimum height drain guide.
   2. Fittings:
      a. Matching band connectors.
      b. Sleeve gaskets in accordance with manufacturer's recommendations.

C. Spiral Rib Metal Pipe:
   1. Pipe: ASTM A 760, Type 1R; Galvanized, aluminized or bituminous coated as indicated on Drawings.
   2. Fittings: Provide re- corrugated pipe ends with semi-corrugated Hugger-type bands and "O" ring gaskets in accordance with manufacturers recommendations.

D. Polyvinyl Chloride (PVC) Pipe:
   1. Pipe: ASTM D 3034, SDR 35 Rated.
      a. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
   2. Joints: ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.

E. High-Density Polyethylene (HDPE) Pipe:
   1. Pipe: AASHTO M252, M294 & MP7-97 Type “S” (Corrugated Polyethylene Pipe).
      a. Pipe shall have a smooth interior and a corrugated annular exterior.
      b. Continuously mark pipe with manufacturer's name, pipe size and AASHTO classification.
      c. Pipe shall be installed per manufacturer’s recommendations.
      d. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
         1) Hancor, Findlay, OH (888) 367-7473: Sure-Lok F477.
         2) Section 016000 - Product Requirements: Product options and substitutions. Sustitutions: permitted.
   2. Joints: Pipe shall be joined with a bell and spigot joint incorporating ASTM F477 gasket material insuring a leak resistant performance.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

A. Lid and Frame: Cast iron as indicated on Drawings.

B. Structure: As indicated on Drawings.

C. Concrete: Specified in Section 033000.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
   2. Verify that trench cut and excavation is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.

C. Report in writing to the General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench as specified in Section 31 2300. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM D 2321 or manufacturer's published instructions, and state or local requirements. Seal joints watertight.

B. Install pipe on minimum 4 inch bedding as specified in Section 31 2300.

C. Lay pipe to slope gradients indicated on Drawings.

D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness equal to paving subgrade indicated on Drawings.

E. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 334913 for manhole requirements.

G. Connect to municipal storm sewer systems, manholes, and inlets as indicated on Drawings.

3.5 INSTALLATION - CATCH BASINS, INLETS, AND JUNCTION BOXES

A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at required elevations.

C. Form and place cast-in-place concrete walls, sleeved at required elevation, to receive storm sewer pipe as indicated on Drawings.

D. Form and place cast-in-place top of structure as indicated on Drawings.

E. Mount grate and frame level, in grout, secured to top section at elevation indicated.

3.6 CONSTRUCTION

A. Interface with Other work: Coordinate the Work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

3.7 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field inspection and testing.

B. Site Tests:
   1. Perform inspections prior to and immediately after placing bedding.
   2. Compaction: Specified in Section 312300.
      a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
      b. Frequency of Tests: One test for each 50 lineal feet of trench.
   3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
      a. Pressure Test.
      b. Infiltration Test.
      c. Deflection Test.

END OF SECTION

SECTION 33 5100

NATURAL-GAS DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for site utility natural gas distribution.

B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 31 2300 - Excavation and Fill: Earthwork for utilities.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 pound Rammer and an 18 inch Drop.

B. American Society of Mechanical Engineers (ASME):
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   4. ASME Sec. 8D - Pressure Vessels.
   5. ASME Sec. 9 - Welding and Brazing Qualifications.
   6. ASME Boiler and Pressure Code.

C. American Society for Testing and Materials (ASTM):
   1. ASTM B 32 - Specification for Solder Metal.
   2. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
   3. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
   4. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
   5. ASTM B75 - Specification for Seamless Copper Tube.
   6. ASTM B88 - Specification for Seamless Copper Water Tube.
   7. ASTM D2513 - Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
   8. ASTM D2517 - Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.
   9. ASTM D2683 - Specification for Socket Type Polyethylene Fittings For Outside Diameter Controlled Polyethylene Pipe and Tubing.
   10. ASTM D2922 - Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
   11. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. American Welding Society (ASTM):
   1. AWS A5.8 - Brazing Filler Metal.

E. American Water Works Association (AWWA):
   1. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.

F. American National Standards Institute (ANSI):
   1. ANSI B16.3 - Malleable Iron Threaded Fittings.
   2. ANSI B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
   3. ANSI B31.2 - Fuel Gas Piping.
   4. ANSI B31.8 - Gas Transmission and Distribution Piping Systems.

G. National Fire Protection Association (NFPA):
   1. NFPA 54 - National Fuel Gas Code.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.
   1. Product Data: Data for each type of pipe, pipe fitting, valve, and accessory specified.
   2. Assurance/Control Submittals:
      a. Certificates: Manufacturer's certificate certifying that Products meet or exceed specified requirements and standards.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
   1. Project Record Documents: Accurately record the following:
      a. Locations of piping mains, valves, connections, and top of pipe elevations.
      b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Perform work in accordance with Utility Company requirements and authority having jurisdiction.
   1. Conform to NFPA 54 ANSI B31.2 and ANSI B31.8.

B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.

D. Welders Certification: In accordance with ASME Sec 9.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

A. Steel Pipe Below Ground: ASTM A 53, Schedule 40 black:
   1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
   2. Joints: Welded and seamless.
   3. Jackets: AWWA C 105 polyethylene jacket, double layer, half lapped, 10 mil polyethylene tape.

B. Steel Pipe Above Ground: ASTM A53 Schedule 40 black:
   1. Fittings: ANSI B16.3, malleable iron, ANSI Bl6.11, forged steel, or ASTM A 234, forged steel welding type.
   2. Joints: Threaded.

C. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
   1. Fittings: ASTM D 2513.
   2. Joints: Mechanical or Compression fit.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

D. Reinforced Epoxy Resin Piping: ASTM D 2517:
   1. Fittings: ASTM D 2517.
   2. Joints: Bell and spigot with epoxy resin.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS

A. 2 Inches and Smaller: 150 psig WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.

B. 2 Inches and Larger: 125 psig WOG, Steel or Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.

C. Applications With Line Pressure Greater Than 60 psig, Over 2 Inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 PRESSURE REGULATING VALVES

A. Valves: Single stage, malleable iron body, corrosion- resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends larger than 2 inch.

B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that building service connection and utility gas main size, location, and depth are as indicated.

C. Report in writing to General Services Director or Designee prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City of Torrance.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. Cut pipe ends square, ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2 inches diameter thread ferrous pipe 2 inches diameter and under.

D. Remove scale and dirt, on inside and outside, before assembly.

E. Prepare piping connections with flanges or threading and unions.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of subgrade as indicated on Drawings.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPING

A. Maintain separation of gas line from sewer, water or storm water piping in accordance with state or local code.

B. Install piping to allow for expansion and contraction without stressing pipe or joints.

C. Connections with Existing Pipelines: Where connections are made between new Work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local Utility Company.

D. Install cocks and other fittings as required.

E. Establish elevations of buried piping in accordance with Section 312300 for Work in this Section.

F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.

G. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.

H. Backfill trench in accordance with Section 312300.

I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti-rust primer and one coat of epoxy paint.

3.5 SERVICE CONNECTIONS

A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.

B. Anchor service main to interior surface of foundation wall.

C. Install service regulator adjacent to building wall in specified location.

D. Install service regulator and riser pipe to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.

E. Provide regulator vent with rain and insect proof opening, terminating not less than five feet away from building openings.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Site Tests:
   1. Compaction:
      a. Perform inspections prior to immediately after placing bedding.
      b. Perform tests as specified in Section 312300.
   2. Piping:
      a. Test, and purge gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.
      b. Verify capacities and pressure ratings of gas meters, regulators, and valves.
      c. Verify required pressure settings for pressure regulators.

C. Inspections: Inspect gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.

END OF SECTION