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Diane
B.
SIA

ORDINANCE NUMBER O- 19939 (NEW SERIES)

DATE OF FINAL PASSAGE MAR 26 2010

AN ORDINANCE OF THE COUNCIL OF THE CITY OF
SAN DIEGO AUTHORIZING A TEN YEAR LEASE
AGREEMENT WITH THE HOUSING COMMISSION FOR
OFFICE SPACE FOR THE FAMILY JUSTICE CENTER AT
1122 BROADWAY (SMART CORNER BUILDING).

WHEREAS, the City's lease for the San Diego Family Justice Center [FJC] at 707
Broadway will expire on September 30, 2010; and

WHEREAS, following an extensive search for a new lease of suitable, cost-effective
facilities, City staff have negotiated favorable lease terms with the San Diego Housing
Commission for space in the Smart Corner building located at 1122 Broadway, San Diego,
California 92101; and

WHEREAS, the lease terms are for ten (10) years commencing October 1, 2010, with an
occupancy of approximately 22,216 square feet at \$1.70 per square foot per month (i.e., annual
rent of \$453,206.40) with a 6% rent increase every 24 months; and

WHEREAS, the proposed lease provides a sufficient tenant improvement allowance for
construction incorporating "LEED Green Building Requirements" to reduce operating expenses;
and

WHEREAS, the proposed lease will reduce the Fiscal Year 2011 budget for the FJC lease
by \$16,593.60; NOW, THEREFORE,

BE IT ORDAINED, by the Council of The City of San Diego, that the Mayor or his
designee is authorized to execute a ten (10) year lease agreement with the Housing Commission
for office space for the San Diego Family Justice Center at 1122 Broadway, San Diego

California 92101 (i.e., Smart Corner Building), a copy of which is on file in the Office of the City Clerk as Document No. RR- **19939**.

Section 2. That a full reading of this ordinance is dispensed with prior to its passage, a written or printed copy having been available to the City Council and the public prior to its passage.

Section 3. That this ordinance shall take effect and be in force on the thirtieth day from and after its final passage.

APPROVED: JAN I. GOLDSMITH, City Attorney

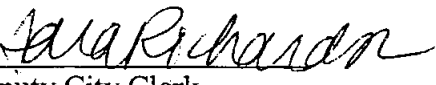
By


Brock Ladewig
Deputy City Attorney

BL:mm
02/12/10
02/22/10 Rev. Copy
Or. Dept: READ
O-2010-76
MMS# 811564

I hereby certify that the foregoing Ordinance was passed by the Council of the City of San Diego, at this meeting of MAR 16 2010.

ELIZABETH S. MALAND
City Clerk

By 
Deputy City Clerk

Approved: 3-26-10
(date)


JERRY SANDERS, Mayor

Vetoed: _____
(date)

JERRY SANDERS, Mayor

**SECOND FLOOR
THE SMART CORNER
1122 BROADWAY
SAN DIEGO, CALIFORNIA**

**OFFICE LEASE
City of San Diego [Family Justice Center]**

THIS OFFICE LEASE ("Lease") is entered into by and between SAN DIEGO HOUSING COMMISSION, a public agency ("Landlord"), and THE CITY OF SAN DIEGO, a California municipal corporation ("Tenant"), to be effective as of **February 1, 2010** (the "Effective Date"), when approved and authorized by the parties' respective governing bodies and in compliance with applicable laws, signed by the parties, and approved by their respective attorneys, as follows:

1. Definitions.

"**Additional Rent**" shall have that meaning ascribed to it in Section 4(c) of this Lease.

"**Base Rent**" shall have that meaning ascribed to it in Section 4(b) of this Lease.

"**Building**" means the building commonly known as The Smart Corner, located at 1122 Broadway, San Diego, California.

"**Building Rules and Regulations**" means the rules and regulations which may hereafter be adopted by Landlord for the care, protection, cleanliness, and operation of the Premises and the Project, and any reasonable modifications or additions to such rules and regulations adopted by Landlord so long as the same does not negatively impact the Project or Premises or Tenant's use, occupancy and enjoyment thereof or Tenant's rights under this Lease. Notwithstanding the foregoing, Landlord and Tenant agree that the terms and conditions of this Lease shall control the rights and responsibilities of the parties and shall supersede any and all provisions of the Building Rules and Regulations which may now or in the future conflict with the terms and conditions of this Lease. Landlord shall not be responsible to Tenant for failure of any other tenant or occupant of the Building to observe or comply with any of the Building Rules and Regulations. The term "Building Rules and Regulations" shall be deemed to include any and all reasonable amendments made by Landlord to the Building Rules and Regulations after the date of this Lease as Landlord may deem desirable, in Landlord's reasonable discretion, for the proper and efficient operation and maintenance of the Building. Such rules and regulations may include, without limitation restrictions in the hours during which the Building will be open for use so long as the same does not negatively impact the Project or Premises or Tenant's use, occupancy and enjoyment thereof or Tenant's rights under this Lease.

"**Commencement Date**" means the later of (i) October 1, 2010; or, (ii) the first day of the month following fourteen (14) calendar days after Substantial Completion, provided Tenant has been allowed fourteen (14) days of access to the Premises as set forth in Section 5(c) of this

Lease. If such access has not been provided, the Commencement Date shall be the later of: (iii) October 1, 2010; or, (iv) the first day of the month following said fourteen (14) days of access.

"Garage" means the parking garage located generally underneath the Building. No leasehold estate is created by this Lease, or otherwise, for the Garage or any portion of it.

"Hazardous Material" means:

(1) Those substances included within the definitions of "hazardous substance," "hazardous waste," "hazardous material," "toxic substance," "solid waste," "pollutant" or "contaminant" in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. §9601 et seq.); the Resource Conservation and Recovery Act (42 U.S.C. §6901 et seq.); the Clean Water Act (33 U.S.C. §2601 et seq.); the Toxic Substances Control Act (15 U.S.C. §9601 et seq.); the Hazardous Materials Transportation Act (49 U.S.C. §1801 et seq.); or under any other applicable environmental law;

(2) Those substances included within the definitions of "Extremely Hazardous Waste," "Hazardous Waste," or "Restricted Hazardous Waste," under §§25115, 25117 or 25122.7 of the California Health and Safety Code, or listed or identified pursuant to §§25140 or 44321 of the California Health and Safety Code;

(3) Those substances included within the definitions of "Hazardous Material," "Hazardous Substance," "Hazardous Waste," "Toxic Air Contaminant" or "Medical Waste" under §§25281, 25316, 25501, 25501.1, 25023.2 or 39655 of the California Health and Safety Code;

(4) Those substances included within the definitions of "Oil" or a "Hazardous Substance" listed or identified pursuant to §311 of the Federal Water Pollution Control Act, 33 U.S.C. §1321, as well as any other hydrocarbonic substance or by-product;

(5) Those substances included within the definitions of "Hazardous Waste," "Extremely Hazardous Waste," or an "Acutely Hazardous Waste" pursuant to Chapter 11 of Title 22 of the California Code of Regulations;

(6) Those substances listed by the State of California as a chemical known by the State to cause cancer or reproductive toxicity pursuant to §25249.9(a) of the California Health and Safety Code;

(7) Any material which due to its characteristics or interaction with one or more other substances, chemical compounds, or mixtures, damages or threatens to damage, health, safety, or the environment, or is required by any law or public agency to be remediated, including remediation which such law or public agency requires in order for the property to be put to any lawful purpose;

(8) Any material whose presence would require remediation pursuant to the guidelines set forth in the State of California Leaking Underground Fuel Tank Field Manual, whether or not the presence of such material resulted from a leaking underground fuel tank;

(9) Pesticides regulated under the Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. §136 et seq.;

(10) Asbestos, PCBs, and other substances regulated under the Toxic Substances Control Act, 15 U.S.C. §2601 et seq.;

(11) Any radioactive material including without limitation any "source material," "special nuclear material," "by-product material," "low-level wastes," "high-level radioactive waste," "spent nuclear fuel" or "transuranic waste," and any other radioactive materials or radioactive wastes, however produced, regulated under the Atomic Energy Act, 42 U.S.C. §§2011 et seq., the Nuclear Waste Policy Act, 42 U.S.C. §§10101 et seq., or pursuant to the California Radiation Control Law, California Health and Safety Code §§25800 et seq.;

(12) Any material regulated under the Occupational Safety and Health Act, 29 U.S.C. §§651 et seq., or the California Occupational Safety and Health Act, California Labor Code §§6300 et seq.;

(13) Any material regulated under the Clean Air Act, 42 U.S.C. §§7401 et seq. or pursuant to Division 26 of the California Health and Safety Code;

(14) Those substances listed in the United States Department of Transportation Table (49 CFR Part 172.101), or by the Environmental Protection Agency, or any successor agency, as hazardous substances (40 CFR Part 302);

(15) Other substances, materials, and wastes that are or become regulated or classified as hazardous or toxic under federal, state or local laws or regulations;

(16) Any material, waste or substance that is:

- (i) a petroleum or refined petroleum product;
- (ii) asbestos;
- (iii) polychlorinated biphenyl;
- (iv) designated as a hazardous substance pursuant to 33 U.S.C. §1321 or listed pursuant to 33 U.S.C. §1317;
- (v) a flammable explosive; or
- (vi) a radioactive material; and

(17) Substances defined, or as may be defined, as "hazardous substances," "hazardous materials," or "toxic substances" in the Safe Drinking Water Act (42 U.S.C. §§ 300f et seq.), the Toxic Substances Control Act (15 U.S.C. §§ 2601 et seq.), the Clean Air Act

(42 U.S.C. §§ 7401 et seq.), California Health & Safety Code §§ 25100 et seq. and §§ 39000 et seq., the California Safe Drinking Water & Toxic Enforcement Act of 1986 (California Health & Safety Code §§ 25249.5 et seq.), the Porter-Cologne Water Quality Control Act (California Water Code §§ 13000 et seq.), any and all amendments and recodifications of the foregoing laws and any rules or regulations adopted and publications promulgated pursuant to said laws; and

(18) (i) any other substance which results in liability to any person or entity from exposure to such substance under any statutory or common law theory; (ii) any matter or substance which is in excess of relevant and appropriate levels set forth in any applicable federal, state, or local laws or regulations pertaining to the regulation of any hazardous or toxic substance, material or waste, or for which any applicable federal, state or local agency orders or otherwise requires the removal, treatment or remediation; (iii) asbestos; (iv) urea formaldehyde foam insulation; (v) transformers or other equipment which contain dielectric fluid containing levels of polychlorinated biphenyls (PCBs) in excess of fifty (50) parts per million; or (vi) any other chemical, material, or substance, to which exposure is prohibited, limited or regulated by any governmental authority or agency or which may or could pose a hazard to the health and safety of the occupants of the Building or the owners of property adjacent to the Building.

“Initial Improvements” means the tenant improvements constructed by Landlord in the Premises prior to Tenant’s initial occupancy following the issuance of a certificate of occupancy granted by the City of San Diego for the Premises, and described in the Plans and Specifications.

“Landlord” means the San Diego Housing Commission, a public agency.

“Landlord’s Affiliates” means collectively the City of San Diego, the Housing Authority of the City of San Diego, and all of their respective members, directors, council members, employees, agents, affiliates, management and other contractors.

“Normal Business Hours” means between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, and 8:00 a.m. to 3:00 p.m. on Saturdays, with legal holidays excepted.

“Plans and Specifications” means the plans and specifications for the Initial Improvements, approved by Landlord and Tenant, and which are attached hereto as ***Exhibit B: Plans and Specifications***.

“Premises” means the approximately 22,216 rentable square feet comprising the entire second floor of the Building, as shown on the Premises Floor Plan. Notwithstanding the foregoing, the cable trays above the ceiling on the second floor, the “IDF room” and the “Electrical Room” on the second floor of the Building are not included as a part of the Premises. All measurements of usable and rentable square footage, which Tenant may independently verify within ninety (90) days after the Commencement Date, shall be computed in accordance with the American National Standard of measuring floor area in office buildings of the Building Owners and Managers Association International (ANSI/BOMA Z65.1-1996).

“Premises Floor Plan” means the floor plan of the Premises attached hereto as ***Exhibit A: Premises Floor Plan***.

“Project” means the Building, Garage and surrounding real property to the extent owned by Landlord.

“Rent” means collectively Base Rent and Additional Rent.

“Substantial Completion” means completion of the construction of the Initial Improvements as evidenced by a certificate of occupancy granted by the City of San Diego for the Premises.

“Tenant” means The City of San Diego, a California municipal corporation.

“Term” shall have that meaning ascribed to it in Section 3 of this Lease.

“TI Allowance” shall have that meaning ascribed to it in Section 5(a) of this Lease.

2. Lease of the Premises. Landlord hereby leases the Premises to Tenant and Tenant hereby leases the Premises from Landlord.

3. Term. Unless sooner terminated pursuant to the terms of this Lease, the term of this Lease (“Term”) shall be ten (10) years, plus any extensions exercised hereunder, beginning on the Commencement Date.

(a) Option to Extend. Provided Tenant is not in default of this Lease, Tenant shall have two (2) five-year options to extend the Term (“Option to Extend”) at ninety percent (90%) of the fair market rent then prevailing for similar office space in comparable buildings in the same market area as the Building, including without limitation all concessions being offered at such time. Tenant may exercise an Option to Extend at any time by written notice to Landlord at least nine (9) months prior to the expiration of this Lease.

(b) Tenant’s Termination Right. Provided Tenant is not in default of this Lease, Tenant may terminate this Lease at any time after the fifth (5th) year of the Term, but only upon six (6) months prior written notice to Landlord. Before the effective date of such termination, Tenant shall reimburse Landlord for Landlord’s unamortized costs of both the brokerage commissions related to this Lease and the TI Allowance, applying a six percent (6%) simple interest rate, amortized on a straight-line basis.

4. Rent and Security Deposit.

(a) Security Deposit. Tenant shall not be required to pay any deposit under the terms of this Lease.

(b) Base Rent. Tenant shall pay Landlord full-service, gross monthly rent (the “Base Rent”) in the amount of One Dollar and Seventy Cents (\$1.70) per rentable square foot per month (i.e., Thirty-Seven Thousand Seven Hundred Sixty-Seven Dollars and Twenty Cents (\$37,767.20), due and payable in advance on the first (1st) day of each month during the Term.

Notwithstanding the foregoing, Tenant shall pay the first month's Base Rent to Landlord upon execution of this Lease. The Base Rent shall increase every twenty-four (24) months, measured from the Commencement Date, by an amount which is six percent (6%) more than the prior year's Base Rent. All Rent may be paid by check and delivered personally or by First Class Mail to Landlord's designated agent at 1122 Broadway, Suite 300, San Diego, California. 92101.

(c) Additional Rent. In addition to the Base Rent, Tenant shall pay to Landlord as additional Rent ("Additional Rent") Tenant's pro rata share (the "Tenant Share") of the amount by which the then current year's "Office CAM Pool" (defined below) exceeds the Office CAM Pool for the calendar year beginning on January 1, 2011 (the "Base Year"); provided, however, there shall be no pass through of Operating Expenses until January 1, 2012. The Tenant Share shall be calculated using twenty-one and nine one-hundredths percent (21.09%), which amount was calculated by dividing the rentable square footage of the Premises by the rentable square footage of the office-space component of the Building. The direct "Operating Expenses" (defined below) shall be adjusted to reflect one hundred percent (100%) occupancy of the Building. There shall be no cap on the pass-through of Operating Expenses when calculating the Tenant Share. Each year, Landlord shall deliver to Tenant an estimate of the Tenant Share.

(1) Installment Payments. Together with its payment of the Base Rent, Tenant shall pay to Landlord a monthly installment of one-twelfth (1/12) of the estimated Tenant Share. If Landlord does not provide Tenant with an estimate of the Tenant Share for a given year by January 1 of that year, Tenant shall continue to pay monthly installments based on the most recent year's estimate until Landlord provides Tenant with a new estimate. Landlord shall revise the estimate of the Tenant Share at any time and from time to time to reflect changing costs to minimize the amount of the annual reconciliation of the estimated Tenant Share with the actual Tenant Share (discussed below). After receiving such a revised estimate, Tenant's monthly installments of the estimated Tenant Share shall be based on the revised estimate.

(2) Annual Reconciliation. As soon as practicable after each calendar year, Landlord shall furnish Tenant with a statement of the actual Tenant Share for the prior calendar year (the "Landlord's Statement"). If Tenant overpaid the Tenant Share for the prior calendar year, Landlord shall either provide Tenant with a refund or apply such overpayment to Rent due or next becoming due; provided, however, if the Term expires before the determination of the overpayment, Landlord shall refund the overpayment to Tenant after first deducting any unpaid Rent. If Tenant underpaid the Tenant Share, Tenant shall pay Landlord the amount of the underpayment within sixty (60) days after receipt of the Landlord's Statement.

(3) Retail CAM Pool and Office CAM Pool. Landlord shall compute and maintain two (2) separate operating expense pools, one for the ground-floor retail component of the Building ("Retail CAM Pool") and a second for the office-space component of the Building ("Office CAM Pool"). To the extent that any amounts properly incurred as Operating Expenses hereunder are incurred solely with respect to the ground-floor retail component of the Building such costs shall be allocated to the Retail CAM Pool. To the extent that any amounts properly incurred as Operating Expenses hereunder are incurred solely with respect to the office-space component of the Building, such costs shall be allocated to the Office CAM Pool. To the extent

any amounts properly incurred as Operating Expenses hereunder are incurred with respect to or benefit of the entire Building and/or both the ground-floor retail component of the Building and the office-space component of the Building, Landlord shall allocate such amounts between the Retail CAM Pool and the Office CAM Pool by allocating four and fifty-eight one-hundredths percent (4.58%) to the Retail CAM Pool and ninety-five and forty-two one-hundredths percent (95.42%) to the Office CAM Pool.

(4) Operating Expenses Defined. "Operating Expenses" shall mean the reasonable cost of insurance required and obtained by Landlord pursuant to this Lease, and the aggregate of all costs and expenses payable by Landlord in connection with the ownership, operation, management, maintenance, cleaning, and repair of the Project. Operating Expenses shall include without limitation the costs of: (a) landscaping, repaving, resurfacing, repairing, replacing, painting, lighting, cleaning, and removing trash and similar items with respect to the Common Areas; (b) all taxes; (c) utilities, including water and electricity; (d) trash disposal service; (e) operating, repairing, and maintaining life-safety systems, including without limitation sprinkler systems; (f) operating, repairing, and maintaining the heating and air conditioning ("HVAC") system and elevator services; (g) painting, window washing, general cleaning, and janitorial services for the Building; (h) monitoring services, if provided by Landlord, including without limitation monitoring or control devices used by Landlord in regulating the parking areas; (i) compensation (including employment taxes and fringe benefits) of all persons who perform duties connected with the operation, maintenance, and repair of the Building or Common Areas; (j) energy allocation, energy use surcharges, or environmental charges; (k) municipal inspection fees or charges; (l) any other costs or expenses incurred by Landlord in connection with the Common Areas which are not otherwise reimbursed directly by tenants; (m) management fees; (n) that part of office rent or rental value of space used or furnished by Landlord to enhance, manage, operate, and maintain the Project; (o) accounting, consulting, and legal fees and expenses incurred in connection with the operation and maintenance of the Project or any other costs related thereto; and (p) any additional services which Landlord reasonably deems necessary in connection with the management or operation of the Project. The computation of Operating Expenses shall be made in accordance with generally accepted accounting principles consistently applied. Charges for any services, goods, or materials furnished by Landlord at Tenant's request and charges for services, goods, and materials furnished by Landlord as a result of uses or demands by Tenant in excess of those charges which are normally furnished to other tenants in the Building, and all other sums payable by Tenant under this Lease shall not be included in Operating Expenses, but shall be payable by Tenant within sixty (60) days after Landlord delivers a statement for such services, goods, or materials to Tenant. Operating Expenses shall not include any brokerage fees or costs with respect to the Building, or costs of acquisition of new land or construction of new buildings, any expenditures for which Landlord is reimbursed from any source (e.g., other reimbursements from tenants for common expenses), including without limitation insurance and condemnation proceeds, and expenses in connection with services or other benefits of a type that are not provided to another tenant or occupant of the Building. Operating Expenses shall not exceed the reasonable and customary expenses for buildings of similar location and character to that of the Building. Tenant may review Landlord's books and records at all reasonable times.

(5) Base Year Cleaning & Maintenance. Landlord shall provide and include within the Base-Year Operating Expenses five (5)-days-per-week office janitorial services and maintenance of the Building systems, Building exterior and Common Areas.

(6) Operating Expense Exclusions. Operating Expenses shall expressly exclude the following without limitation:

- (a) Repairs or other work to the Project occasioned by any uninsured fire, windstorm, or other casualty;
- (b) Leasing commissions, attorney's fees, costs and disbursements and other expenses incurred in connection with negotiations or disputes with tenants, other occupants or prospective tenants or other occupants of the Project;
- (c) Costs incurred in renovating or otherwise improving or decorating or redecorating space for tenants in, or other occupants of, the Project, or vacant, leasable space in the Project;
- (d) Costs of correcting defects in the construction of the Project (including latent defects in the improvements or equipment used therein);
- (e) Interest on debt or amortization payments on mortgages, and rental under ground or underlying leases (except to the extent the same may be made to pay or reimburse, or may be measured by, ad valorem taxes);
- (f) Costs of Landlord's general corporate or partnership overhead and general administrative expenses, which costs would not be charged to the Operating Expenses of the Building in accordance with generally accepted accounting principles, consistently applied;
- (g) Costs incurred in advertising and promotional activities for the Project;
- (h) Costs incurred due to the violation by Landlord or any tenant of the terms and conditions of any lease pertaining to the Project or of any valid, applicable building code, regulation or law or incurred due to the Project being in violation of any such code, regulation or law;
- (i) The management fee, overhead, and/or profit increments paid to subsidiaries or affiliates of Landlord for service on or to the Project, to the extent the costs of such services exceed reasonable costs for such services rendered by unaffiliated persons or entities of similar skill, competence, and experience;
- (j) Any compensation paid to clerks, attendants, or other persons in commercial concessions, if any, operated by Landlord;
- (k) Landlord's costs of general electricity and other services sold to tenants, which services are not standard for the Project;
- (l) Any other expenses which, under generally accepted accounting principles, consistently applied, would not be rendered as a normal maintenance or operating expense of the Project;

- (m) Salaries of officers and executives of Landlord and of Project staff members above the grade of Building Manager;
- (n) The costs of any items for which Landlord is reimbursed by insurance or otherwise;
- (o) The cost of any repair necessitated by a total or partial taking by eminent domain, excluding any costs of any repair necessitated by a total or partial taking by the City of San Diego;
- (p) Insurance premiums to the extent of any refunds thereof; and
- (q) Any expenses for repairs or maintenance which are reimbursed through warranties or service contracts.

(7) Disputed Landlord's Statement. If Tenant disputes a Landlord's Statement, Tenant may at any time deliver to Landlord a written notice of such dispute ("Dispute Notice"). The Dispute Notice shall specify the items in the Landlord's Statement claimed to be incorrect. If Landlord disagrees with the Dispute Notice, Landlord and Tenant shall mutually select an independent certified public accountant (a "Neutral Accountant") of national standing not compensated on a contingency fee or similar basis relating to the results of such audit. Landlord and Tenant shall each pay fifty percent (50%) of the Neutral Accountant's costs and fees. The Neutral Accountant shall review Landlord's Statement and any pertinent supporting documentation and render an opinion regarding the items in dispute. The Neutral Accountant's opinion shall be deemed correct and shall be conclusively binding on both Landlord and Tenant. If Tenant is found to have overpaid items disputed in the Landlord's Statement, the amount of overpayment shall be credited against Tenant's obligations to pay Rent next becoming due, or reimbursed to Tenant if no such amounts shall become owing. If Tenant is found to have underpaid items disputed in the Landlord's Statement, Tenant shall pay the amount of such underpayment to Landlord within sixty (60) days after receipt of the Neutral Accountant's opinion.

(d) Delinquent Rent.

(1) Grace Period. No Rent or other monetary obligation of Tenant's under this Lease shall be delinquent until after the fifth (5th) day following the applicable payment's due date. All interest and late charges allowed under this Lease shall be calculated as of the due date of the applicable payment and not from the date of expiration of any grace period.

(2) Interest. Any amount due from Tenant to Landlord which is not paid when due shall bear interest at six percent (6%) per annum from the date such payment was due until paid.

(3) Late Charges. Tenant acknowledges that in addition to lost interest, the late payment by Tenant to Landlord of Rent or any other sums due hereunder will cause Landlord to incur other costs not contemplated in this Lease, the exact amount of which will be extremely difficult and impracticable to ascertain. Such other costs include, but are not limited to, processing, administrative and accounting costs. Accordingly, if any installment of Rent or

other sum due from Tenant to Landlord is delinquent, Tenant shall pay to Landlord, immediately upon receipt of notice from Landlord, as Additional Rent, a late charge equal to five percent (5%) of such delinquent amount. The parties agree that: (i) such late charge represents a fair and reasonable estimate of the costs Landlord will incur in processing such delinquent payment by Tenant; (ii) such late charge shall be paid to Landlord as liquidated damages for each delinquent payment pursuant to California Civil Code Section 1671; and (iii) the payment of late charges and the payment of interest are distinct and separate from one another in that the payment of interest is to compensate Landlord for the use of Landlord's money by Tenant, while the payment of late charges is to compensate Landlord for the additional administrative expense incurred by Landlord in handling and processing delinquent payments.

(4) No Waiver. Neither assessment nor acceptance of interest or late charges by Landlord shall constitute a waiver of Tenant's breach or default with respect to any overdue amount, nor prevent Landlord from exercising any of its other rights and remedies under this Lease. Nothing contained in this Section 4(d) shall be deemed to condone, authorize, sanction or grant to Tenant an option for the late payment of Rent or other sums due hereunder.

5. Alterations.

(a) Initial Improvements. Landlord, at Landlord's expense, shall provide a tenant improvement allowance (the "TI Allowance") of up to Seventy Dollars (\$70) per rentable square foot for use by Tenant to make the Initial Improvements. The TI Allowance shall include the costs of design, plans, and permits. The Initial Improvements shall be consistent with "LEED Green Building Requirements" and shall be completed by Landlord's contractor. The Initial Improvements shall be subject to approvals by Landlord, the City of San Diego, and to the extent necessary, Centre City Development Corporation and the Redevelopment Agency of the City of San Diego.

(1) Tenant may use the TI Allowance for any and all reasonable costs associated with moving, including without limitation cabling, signage, project management, security and movers ("Reasonable Moving Costs"), provided Tenant shall only be allowed to apply TI Allowance monies toward Reasonable Moving Costs after the TI Allowance has been first applied to the physical improvements and related costs, including without limitation design, plans, and permits. Landlord shall pay Tenant's vendors directly for Reasonable Moving Costs upon presentation of invoices.

(2) The TI Allowance shall not be reduced by costs legally required to be made by Landlord as owner of the Project, such as modifications and upgrades to the building core for life safety backbone and ADA compliance regarding the building core.

(3) Landlord represents that the base building shell has been designed and constructed with adequate system capacity to allow for the build-out of the Premises consistent with a Class A building. Landlord further represents that the existing improvement of the Premises has been completed in a workmanlike manner and in accordance with applicable regulations and ordinances for unoccupied space.

(4) In addition to the TI Allowance, Landlord shall pay Tenant's architect for a preliminary test fit, which shall not be deducted from the TI Allowance.

(b) Timing of Construction of Initial Improvements.

(1) Not later than March 1, 2010, Landlord shall provide Tenant with a final tenant improvement plan ("Plan"). Within five (5) business days after receipt of the Plan, Tenant shall approve or disapprove the Plan. If approved, Landlord shall prepare an invitation to bid on the Initial Improvements (the "Bid Package"), which shall include line drawings, finish schedules and specifications. Landlord shall solicit bid responses to the Bid Package from contractors. Landlord shall accept the lowest bid price from a responsible bidder, conditioned on approval by Landlord's Board of Commissioners and/or the San Diego Housing Authority, as may be required. Subject to such approval, Landlord shall immediately enter into a contract with the accepted contractor (the "Contractor"), which contract shall provide for Substantial Completion not later than September 15, 2010, which date shall be extended for circumstances beyond the reasonable control of Landlord and/or the Contractor. The Initial Improvements shall be constructed in a good and workmanlike manner. Prior to commencement of construction of the Initial Improvements, Tenant and Landlord shall each designate a tenant-improvement project representative to assure coordination and communication between Landlord, Tenant, and the Contractor.

(2) Tenant has entered into this Lease materially based on Landlord's assurance that Tenant will be able to enter and occupy the Premises prior to October 1, 2010, as contemplated by this Lease, because after that date, Tenant will incur additional rent obligations under its current lease (the "707 Broadway Lease") at 707 Broadway in the city of San Diego. If Tenant is unable to occupy the Premises on or prior to October 1, 2010, as contemplated by this Lease because of failure of the Landlord to timely deliver the space to Tenant, Landlord shall credit Rent payable under this Lease in an amount equal to the difference in the rent paid by the Tenant under the 707 Broadway Lease after October 1, 2010 and the amount of rent that the Tenant would have paid to Landlord under this Lease had the Initial Improvements been completed on or before September 15, 2010.

(3) The following target dates shall be used to monitor Landlord's performance of its obligation to achieve Substantial Completion by September 15, 2010:

Plan Check Submission.	February 8, 2010
Tenant Comments on Initial Submission.	February 15, 2010
Secondary Plan Check.	March 1, 2010
Construction Documents Submitted to Tenant.	March 1, 2010
Tenant & Landlord Review & Approve Construction Documents. ..	March 5, 2010
Lease Approval/Execution.	March 15, 2010
Out to Bid.	March 8, 2010
Bids Due.	April 8, 2010
Commencement of Construction.	May 3, 2010

Substantial Completion of Construction. September 15, 2010
Occupancy. October 1, 2010

Landlord shall notify Tenant immediately upon Landlord's reasonable determination that a milestone date will more likely than not be missed.

(c) Tenant's Entry Prior to Commencement Date. Landlord shall allow Tenant fourteen (14) days of access to the Premises after Substantial Completion and prior to the Commencement Date for the purpose of installing equipment, furniture, trade fixtures, and other personal property, including without limitation cabling and data and telephone equipment. Tenant acknowledges and agrees that such entry into the Premises prior to the Commencement Date may not interfere with the timely and orderly prosecution of the work by Landlord related to the Initial Improvements, and shall be subject to all of the terms and conditions of this Lease, except the payment of Rent.

(d) Subsequent Improvements by Tenant. Tenant shall not make any alterations to or install any fixtures on or in the Premises in excess of \$10,000 in cost without Landlord's written consent. After depletion of the TI Allowance, any fixtures, alterations, improvements or additions consented to by Landlord shall be constructed without cost to Landlord in a first-class, good, workmanlike and defect-free manner by licensed contractors with experience in construction of tenant improvements in Class-A office buildings and approved by Landlord, which approval may be withheld by Landlord in its reasonable discretion. Tenant shall obtain all required permits or licenses required by applicable governmental authorities and Tenant shall be solely responsible for the effect of any alterations made by Tenant on the Premises or the Building, regardless of Landlord's consent to such alterations. Excepting improvements to the Premises made by Landlord, in no event shall Landlord be responsible for repair of or liability to Tenant for any defects in any alterations, improvements or additions to the Premises made or caused to be made by Tenant. Tenant shall give Landlord fifteen (15) days advance notice before beginning any work on alterations to allow Landlord time to file a "Notice of Non-responsibility" and take any other actions in anticipation of such work. Upon completion of the alterations, Tenant shall provide Landlord with a complete set of "as-built" plans.

(e) Alterations by Landlord. Landlord may make alterations or other changes to the Project which Landlord determines in its sole and absolute discretion are necessary or desirable without notice to or consent of Tenant provided the same does not negatively impact the Project or the Premises or Tenant's use, occupancy and enjoyment thereof or Tenant's rights under this Lease. Tenant shall cooperate with Landlord if Landlord elects to make alterations or other changes to the Project.

(f) Removal of Improvements. Tenant shall remove from the Premises all of Tenant's personal property, including without limitation furnishings, machinery, trade fixtures, equipment, and improvements on or before the expiration of the Term, or as soon as practicable after termination of this Lease, but in no event later than sixty (60) days after the termination of this Lease. Tenant shall pay to Landlord rent calculated on a per diem basis using the Base Rent in effect just prior to such termination for any period of time needed to remove Tenant's personal property after the termination of this Lease. Tenant shall repair any damage to the Premises or

the Building caused by such removal, including without limitation patching and filling holes. Notwithstanding the foregoing, Tenant shall not remove or be required to remove, any HVAC systems, restroom fixtures, flooring, plumbing, ceilings, walls, or utility or electrical components.

6. Use.

(a) Permitted Use. Tenant represents and warrants to Landlord that Tenant shall use the Premises only as general office and uses related to the operation of the San Diego Family Justice Center as of the Effective Date. Tenant shall operate its business at the Premises in accordance with all applicable legal requirements applicable to Tenant's use and occupancy of the Premises.

(b) Additional Use Limitations. Tenant shall not permit the occupancy of the Premises at any time during the Term to exceed that allowed by the applicable codes and regulations concerning occupancy. Tenant shall not do or permit anything to be done in or about the Premises which will in any way obstruct or interfere with the rights of other tenants or occupants of the Building or injure or unreasonably annoy them or use or allow the Premises to be used for any unlawful purpose. Tenant's use and occupancy of the Premises shall not create a nuisance. Tenant shall not commit or permit to be committed any waste in or upon the Premises.

(c) Compliance with Laws, Covenants and Requirements. Tenant shall comply with, and shall not use the Premises in any way, or permit or suffer anything to be done in or about the Premises, which will conflict with: (i) any law, rule, or regulation applicable to Tenant and affecting the Project or the Premises, now in force or which may hereafter be promulgated, including without limitation the provisions of any city or county zoning codes regulating the use of the Project or any transportation management program established by any governmental or quasi-governmental entity that is either voluntarily or involuntarily made applicable to the Project; (ii) any covenant, condition or restriction of public record and now in force affecting the Project, including without limitation any notices, letters or other such documentation affecting the Project; (iii) the Americans with Disabilities Act, including without limitation the architectural barrier removal requirements of said Act; or (iv) any licensing requirements of any city, county, or other governmental or quasi-governmental entity regulating Tenant's use of the Premises (collectively referred to as "Applicable Laws, Covenants and Requirements"). Tenant shall promptly notify Landlord of and shall promptly provide Landlord with true, correct and legible copies of all orders, reports, notices and correspondence which are "public records" under the California Public Records Act concerning the investigation, compliance, and corrective actions and all complaints, pleadings, and other legal documents filed against Tenant relating to Tenant's failure to comply with Applicable Laws, Covenants and Requirements. Tenant shall, at its sole cost and expense, promptly comply with all Applicable Laws, Covenants and Requirements in so far as they relate to the specific manner of Tenant's use and occupancy of the Premises. The judgment of any court of competent jurisdiction or the admission by Tenant in any action against Tenant, whether Landlord be a party thereto or not, that Tenant has violated any Applicable Laws, Covenants and Requirements, shall be conclusive of the fact as between Landlord and Tenant. The Building is a non-smoking building and Tenant shall not allow its

employees, agents, contractors, subcontractors, clients, invitees or others using or occupying the Premises to smoke while in the Premises.

(d) Hazardous Material.

(1) Except with respect to commercially packaged products used and stored by Tenant at the Premises, such as common cleaning fluids and supplies, neither Tenant nor Tenant's agents, employees, contractors, invitees, or licensees shall engage in any activity in, on or about the Premises or the Building, nor permit others to engage in any such activity, which will result in the Premises or the Building containing any Hazardous Material. If at any time after the Commencement Date it is determined that Tenant or Tenant's agents, employees, contractors, invitees or licensees, have been responsible for the Premises or the Building containing any Hazardous Material, then Tenant shall be solely responsible for and shall pay for all costs incurred in connection with the removal of the Hazardous Materials to the extent directly or indirectly caused or allowed by Tenant, or any agent, employee, contractor, invitee or licensee of Tenant. The obligations on the part of Tenant set forth in this paragraph 6(d) shall survive the expiration or the earlier termination of this Lease.

(2) Tenant shall promptly comply with the requirements of Section 25359.7(b) of the California Health and Safety Code and/or any successor or similar statute to provide Landlord with written notice that any Hazardous Material has come or will come to be located on or beneath the Premises, or the Project if Tenant discovers or has reasonable cause to believe of the presence of such materials. Should Tenant fail to so notify Landlord, Landlord shall have all rights and remedies provided for such a failure by such Section 25359.7(b) in addition to all other rights and remedies which Landlord may have under this Lease or otherwise. Tenant shall not take any remedial action related to Hazardous Materials located in or about the Premises or the Project and shall not enter into a settlement, consent decree or compromise in response to any claim related to Hazardous Materials without the prior written consent of Landlord, which may be withheld by Landlord in its sole and absolute discretion. Tenant shall immediately notify Landlord in writing of: (i) any enforcement, clean-up, removal or other governmental action instituted, completed or threatened with regard to Hazardous Materials at the Premises or the Project of which Tenant is directly notified; (ii) any claim made or threatened by any person against Tenant, Landlord, the Premises, or the Project related to damage, contribution, cost recovery, compensation, loss or injury resulting from or claimed to result from any Hazardous Materials of which Tenant is directly notified; and (iii) any reports made to any environmental agency arising out of or in connection with any Hazardous Materials at or removed from the Premises, or the Project, including any complaints, notices, warnings or assertions of any violation in connection therewith of which Tenant is directly notified.

(3) In addition to any other indemnity contained in this Lease, Tenant shall defend, indemnify, and hold Landlord and Landlord's Affiliates, excepting the City of San Diego, harmless from and against any and all losses, liabilities, general, special, consequential and/or incidental damages, injuries, costs, expenses, claims of any and every kind whatsoever, including without limitation court costs, reasonable attorneys' fees, damages to any person, the Premises, the Project, or loss of rents, which at any time or from time to time may be paid, incurred or suffered by or asserted against Landlord with respect to, or as a direct or indirect

result of: (i) the breach by Tenant of any of the covenants set forth in this Section 6(d); or (ii) the presence on, under or the escape, seepage, leakage, spillage, discharge, emission, release from, onto or into the Premises or the Project, of any Hazardous Material to the extent directly or indirectly caused or allowed by Tenant, or any agent, employee, contractor, invitee or licensee of Tenant after the Commencement Date. Tenant's indemnification obligations under this Section (6)(d)(3) shall survive the expiration or earlier termination of this Lease.

(e) Compliance with Americans with Disabilities Act and Other Disability, Health and Safety Requirements. Tenant shall comply with all requirements of the ADA, Title 24 and any other Applicable Laws, Covenants and Requirements relating to disabled access and facilities, upgraded fire safety equipment, seismic protection, and other disability and health and safety regulations (collectively, "Disability and Safety Laws") with respect to the Premises, including without limitation the Initial Improvements and any future tenant improvement work performed by Tenant. Notwithstanding the foregoing, compliance with all Disability and Safety Laws with respect to the shell and core of the Premises and all portions of the Building other than the Premises shall be solely the responsibility of Landlord. Tenant shall indemnify, defend and hold Landlord harmless from and against all liabilities, losses, demands, actions, expenses or claims, including reasonable attorneys' fees and court costs to the extent directly arising out of or in any manner connected with Tenant's failure to comply with Disability and Safety Laws, including without limitation, the costs of making any alterations, renovations or accommodations required by Disability and Safety Laws or any governmental enforcement agency, to the extent compliance is directly related to tenant improvement work performed by Tenant. Tenant's indemnification obligations under this Section 6(e) shall survive the expiration or earlier termination of this Lease.

(f) Additional Prohibited Actions of Tenant. Tenant shall not commit or suffer the commission of any acts on the Premises or in the Building, nor use or allow the use of the Premises or the Building in any way that increases the existing rates for, or causes cancellation of, any fire, casualty, liability, or other insurance policy insuring the Building or its contents.

(g) Building Rules and Regulations. Tenant shall, and Tenant shall cause its agents, servants, employees, invitees, and licensees to, observe and comply fully and faithfully with the Building Rules and Regulations. Landlord shall not be responsible to Tenant for failure of any other tenant or occupant of the Building to observe or comply with any of the Building Rules and Regulations.

(h) Inspection of Premises. With prior notice and with an authorized Tenant escort, Landlord may enter upon the Premises at all reasonable times for the purpose of inspecting the condition of the Premises and to determine whether Tenant is complying with its obligations hereunder, to supply any service to be provided by Landlord to Tenant hereunder, to exhibit the Premises to prospective purchasers, mortgagees or tenants, to post notices of nonresponsibility, and to repair the Premises and any other portion of the Building, without abatement of rent, and may for that purpose erect scaffolding and other necessary structures that are reasonably required by the character of the work to be performed by Landlord, provided that the business of Tenant shall not be interfered with unreasonably. With prior notice and with an authorized Tenant escort within the Premises, Landlord may at all times access the cable trays above the ceiling in

the Premises, the IDF room and the Electrical Room on the second floor of the Building. Landlord acknowledges the sensitive and confidential nature of Tenant's operations and shall take all steps reasonably necessary to ensure that access the cable trays above the ceiling in the Premises, the IDF room and the Electrical Room on the second floor of the Building does not unreasonably interfere with Tenant's operations. For each of the aforesaid purposes, Landlord shall have and retain a key with which to unlock all of the doors in, upon and about the Premises, and Landlord may use any and all means which Landlord may deem proper to open such doors in the event of an emergency. Any entry to the Premises or portions thereof obtained by Landlord by any of said means, or otherwise, shall not under any circumstances be construed or deemed to be a forcible or unlawful entry into, or a detainer of, the Premises, or an eviction, actual or constructive, of Tenant from the Premises, or any portion thereof. Any such inspections shall be performed with as little disturbance and inconvenience to Tenant as reasonably possible.

(i) Tenant Acknowledgement of Trolley Easement and Fare Paid Zone. Tenant acknowledges that an easement for the operation and maintenance of a trolley station lies adjacent to the Project, and that such trolley easement may affect Tenant's use of the Premises. Tenant further acknowledges that the trolley platform located on the northeast side of the Building is a "Fare Paid Zone," which requires all persons on the trolley platform to have a trolley ticket or to be in the process of purchasing a trolley ticket.

7. Landlord Warranties and Duties.

(a) Compliance. Landlord warrants and represents that the Premises and the Project, including common areas, are in compliance with all laws, rules and regulations, including without limitation all environmental laws and the Americans with Disabilities Act of 1990, and shall be responsible hereafter for any legal requirements applicable to the shell Building, Garage and common areas.

(b) Hazardous Materials. Landlord shall defend, indemnify and hold Tenant harmless from and against any and all losses, liabilities, general, special, consequential and/or incidental damages, injuries costs, expenses, claims of any and every kind whatsoever, including without limitation court costs, reasonable attorneys' fees, damages to any person, the Premises, the Project or loss of rents which at any time or from time to time may be paid, incurred or suffered by or asserted against Tenant with respect to, or as a direct or indirect result of the presence on, under or the escape, seepage, leakage, spillage, discharge, emission, release from, onto or into the Premises, or the Project, of any Hazardous Material to the extent directly or indirectly caused or allowed by Landlord, or any agent, employee, contractor, invitee or licensee of Landlord during the Term. Landlord's indemnification obligations under this Section (7)(b) shall survive the expiration or earlier termination of this Lease. Tenant acknowledges receipt of: (i) that certain Phase II report prepared by Gradient Engineers dated October 24, 2002 ("Phase II Report"); (ii) that certain Mitigation Plan and Closure Report filed with the County Department of Environmental Health by the Centre City Development Corporation. To the best of Landlord's knowledge, other than as disclosed in the Phase II Report or the Mitigation Plan and Closure Report, no Hazardous Substance has been released, discharged or disposed of on, under or about the Premises or the Project.

8. Services and Utilities.

(a) Utilities. Landlord shall furnish to the Premises, during Normal Business Hours, water and electricity suitable for Tenant's permitted use of the Premises, and HVAC required in Landlord's reasonable judgment for the comfortable use and occupation of the Premises, all of which shall be subject to the Building Rules and Regulations, as well as any governmental requirements or standards relating to, among other things, energy conservation. Tenant may request that Landlord provide HVAC to the Premises at any time outside of Normal Business Hours. After hours HVAC shall be provided upon request at Landlord's standard charge, which shall be no more than is reasonably necessary to cover the costs of providing such HVAC. Elevator service to the Building shall be provided twenty-four (24)-hours a day, subject to any regulations reasonably enacted by Landlord.

(b) Energy Provider. Tenant acknowledges and agrees that the decision whether to change the provider of electricity to the Building and the selection of the provider of electricity to the Building shall be made by Landlord in its sole and absolute discretion. Tenant shall cooperate with Landlord (including providing Landlord upon request at no charge with information regarding Tenant's electrical consumption) to facilitate Landlord's decision-making process. Tenant shall cooperate with Landlord in any present or future government-mandated conservation requirements.

(c) Breaks In Utility Services. Landlord shall not be liable for and Tenant shall not be entitled to any abatement or reduction of rent by reason of Landlord's failure to furnish any utilities and services, including without limitation electricity, water and HVAC, when such failure is caused by any of the following and to the extent beyond the reasonable control of Landlord: (i) accidents, breakage or repairs; (ii) strikes, brownouts, blackouts, riots, civil disturbances, lockouts or other labor disturbances or labor disputes of any character; (iii) governmental regulation, moratorium or other governmental action; (iv) limitation, rationing, curtailment or restriction on the use of water, electricity, gas heating, cooling or other forms of service or utility provided to the Premises; or (v) by any other cause, similar or dissimilar, and beyond the reasonable control of Landlord, nor shall such failure under such circumstances be construed as a constructive or actual eviction of Tenant.

9. Taxes. Tenant and Landlord are both public entities and as such are not subject to the imposition of real estate taxes. Provided Tenant maintains its status as a municipality that is exempt from taxes, Tenant shall pay no taxes under the terms of this Lease. To the extent possessory interest taxes are assessed by any appropriate taxing authority concerning the construction of the Initial Improvements or any other improvement to the Building caused by Tenant, Tenant shall pay, before delinquency, all such taxes, in addition to the Base Rent and Additional Rent payable under this Lease.

10. Maintenance.

(a) Landlord's Maintenance Obligations. Landlord shall keep the Project in a neat, clean, and orderly condition at all times and shall not permit rubbish, waste, or garbage, to

accumulate at any time. Landlord shall not commit or permit any waste of the Project or any acts to be done in violation of any law. Landlord shall repair and maintain, in a first-class manner, in accordance with the practices of other first-class office buildings located in downtown San Diego, the structural portions of the Building and Garage, the systems and equipment, the base-building plumbing, heating, ventilating, air conditioning and electrical systems, mechanical, fire/life safety systems, facilities and components (excluding those systems that are located in the Premises, solely serve the Premises, and are reasonably accessible to Tenant), the common areas of the Project, and the windows, doors, plate glass and exterior surfaces of all walls that are adjacent to the common areas serving the Project and not located in the Premises.

(b) Tenant's Maintenance of the Premises. Tenant shall keep the Premises in a neat, clean and orderly condition, and shall not permit rubbish, waste or garbage to accumulate at any time.

(c) Repair of the Premises. Tenant shall make all repairs and replacements to the Premises, as and when necessary to preserve in a first-class order, condition and repair (less normal wear and tear) the Premises and every part thereof, including without limitation all fixtures, interior walls, interior surfaces of exterior walls, ceilings, windows, doors, cabinets, draperies, window coverings, carpeting and other floor coverings and plate glass located within the Premises, and all utility systems and facilities located within and solely serving the Premises.

(d) Landlord's Right to Make Repairs. If Tenant fails to maintain the Premises in a first-class order, condition and repair as required by this Lease or fails to comply with any applicable laws, regulations or requirements as required by this Lease, then within a reasonable time following written notification to Tenant (except in the case of an emergency, in which case no prior notification shall be required), Landlord may, but shall not be obligated to, enter the Premises at a reasonable time and with an authorized Tenant escort to do such reasonable acts and expend such reasonable funds at the expense of Tenant as required to place the Premises in the condition required by this Lease. The amount so expended by Landlord shall be paid by Tenant within sixty (60) days after demand. Landlord shall have no liability to Tenant for any reasonable inconvenience or interference with Tenant's use of the Premises resulting from Landlord's performance of such maintenance or repair work.

11. Casualty Damage and Casualty Insurance.

(a) Insured Casualties. If the Premises, or any portion thereof, is damaged or destroyed by any casualty that is covered by the insurance maintained by Landlord, then Landlord shall rebuild and restore the Premises, as the case may be, and repair the damaged portion thereof, provided: (i) the amount of insurance proceeds available to Landlord equals or exceeds the cost of such rebuilding, restoration and repair; (ii) such rebuilding, restoration and repair can be completed within one hundred eighty (180) days after the work commences in the opinion of a registered architect or engineer appointed by Landlord; (iii) the damage or destruction has occurred more than twelve (12) months before the expiration of the Term; and (iv) such rebuilding, restoration, or repair is then permitted, under applicable governmental laws, rules and regulations, to be done in such a manner as to return the Premises to substantially its

condition immediately prior to the damage or destruction, including without limitation the same net rentable floor area. If any of the circumstances described in (i) through (iv) above cannot be satisfied, Landlord may, at its option, either: (1) rebuild or restore the Premises or Building, as the case may be, and repair the damaged portion thereof; or (2) elect not to so rebuild or restore and this Lease shall then terminate. To the extent insurance proceeds must be paid to a mortgagee or beneficiary under, or must be applied to reduce any indebtedness secured by, a mortgage or deed of trust encumbering the Premises, or the Building, such proceeds, for the purposes of this Section 11(a), shall be deemed not available to Landlord unless such mortgagee or beneficiary permits Landlord to use such proceeds for the rebuilding, restoration, and repair of the Premises or Building. Notwithstanding the foregoing, Landlord shall have no obligation to repair any damage to, or to replace any of, Tenant's personal property, including without limitation-furnishings, fixtures, and equipment.

(b) Non-Insured Casualties. If the Premises, or any portion thereof, is materially damaged or destroyed by any casualty not covered by Landlord's insurance, then Landlord may, at its option, either (i) rebuild or restore the Premises and repair the damaged portions thereof at Landlord's own expense; or (ii) terminate this Lease effective as of the date the damage or destruction occurred. Within sixty (60) days after the material damage or destruction occurs, Landlord shall notify Tenant of its election to either rebuild or restore the Premises and repair the damaged portions thereof, or to terminate this Lease. Notwithstanding the foregoing, unless Tenant's actions or omissions are the cause of the damage, Tenant may terminate this Lease upon thirty (30) days prior written notice if Landlord elects to perform such repair or restoration and either: (1) such repair or restoration cannot be completed within one hundred eighty (180) days; or (2) the damage or destruction occurs within the last twelve (12) months of the Term. To the extent Tenant's actions or omissions are the cause of the damage, Tenant shall be liable to and shall reimburse Landlord for any and all damages caused thereby.

(c) Minor Casualties. If the Premises are not rendered substantially unfit for the occupancy or use herein contemplated as the result of any insured casualty, Landlord shall promptly and diligently restore the Premises at Landlord's expense to the condition existing prior to the occurrence of the casualty, and the Rent shall be abated to the extent the Premises are not usable as contemplated by this Lease during such restoration period.

(d) Abatement of Rent. Provided this Lease is not terminated as provided in Sections 11(a) or (b), above, Tenant shall be entitled to an abatement of Rent by reason of the damage to or destruction of the Premises, only to the extent that: (i) the floor area of the Premises cannot be reasonably used by Tenant for the conduct of its business; or (ii) Tenant does not have reasonable access to the Premises, in which event the Rent shall abate in the proportion which the approximate area of the damaged or destroyed portion of the Premises bears to the total area of the Premises commencing upon the date the damage to or destruction of the Premises or Building occurred until substantial completion of the repair of such damage or destruction.

12. Insurance.

(a) Tenant Insurance Requirements. Tenant shall, at Tenant's sole cost and expense, maintain in force continuously throughout the Term:

(1) Commercial general public liability and property damage insurance covering the Premises with limits of not less than \$2,000,000 for injury to or death of one or more persons and/or property damage arising out of a single accident or occurrence and \$2,000,000 in the aggregate. All such insurance shall name the Metropolitan Transit Development Board, Landlord and the Housing Authority of the City of San Diego as additional insureds (with cross liability endorsements and an endorsement providing contractual liability for work performed near a railroad). Upon receipt of written request therefor, Tenant shall furnish Landlord a certificate from the insurer evidencing such coverage as required by this Section 12(a)(1);

(2) Worker's compensation insurance, with coverage as required by the State of California;

(3) Fire, extended coverage, and vandalism and malicious mischief insurance, insuring Tenant's personal property, including without limitation furniture, furnishings and fixtures on the Premises for not less than one hundred percent (100%) of the actual replacement value thereof; and

(4) Such other insurance as Landlord or Landlord's lender deems reasonably necessary to carry in connection with the ownership and operation of a first-class building.

(b) Additional Insurance Requirements. Each insurance policy obtained by Tenant pursuant to this Lease shall contain a clause that the insurer shall provide to Landlord at least thirty (30) days prior written notice of any material change, non-renewal or cancellation of the policy and shall be in a form satisfactory to Landlord and shall be taken out with an insurance company authorized to do business in the State of California and rated not less than Financial Class XIII and Policy Holder Rating "A" in the current issue of Best's Insurance Code. In addition, all insurance policies obtained by Tenant shall be written as primary policies, non-contributing with or in excess of any coverage which Landlord may carry, with loss payable clauses reasonably satisfactory to Landlord and in favor of Landlord and naming Landlord and any management agent from time to time designated by Landlord and any lender of Landlord as additional insureds. The liability limits of the above-described insurance policies shall in no way limit the liability of any party under the terms of this Lease. Not more frequently than every two (2) years, if, in the reasonable opinion of Landlord, the amount of liability insurance specified in Section 12(a) is not adequate, such limits of coverage shall be adjusted by Landlord, by written notification to Tenant, to maintain insurance protection at least equal to the protection afforded on the Commencement Date. If Tenant fails to maintain and secure the insurance coverage required under this Section 12, Landlord may, in addition to all other remedies provided herein and by law, but shall not be obligated to, procure and maintain such insurance, the cost of which shall be due and payable to Landlord by Tenant on demand. No policy of insurance required by this Lease shall contain a deductible exceeding Ten Thousand Dollars (\$10,000) per occurrence. Tenant shall be solely responsible for the payment of any deductible.

(c) Self-Insurance. Notwithstanding anything to the contrary contained in this Section 12, Tenant may elect to self insure its obligations under this Section 12, provided Tenant

delivers to Landlord reasonable evidence of such self-insurance and related satisfactory financial ability.

(d) Landlord Insurance Requirements.

(1) Liability Insurance. Landlord shall, at Landlord's expense, maintain in force continuously throughout the Term, commercial general public liability insurance covering the Building (including the Premises) with combined single limit coverage of \$2,000,000 or its equivalent, and shall upon Tenant's written request furnish Tenant a certificate from the insurer evidencing such coverage.

(2) Property Insurance. Landlord shall maintain all-risk property insurance covering the Project, Premises and the Building against loss or damage resulting from fire and other insurable casualties.

13. Indemnity.

(a) Tenant shall indemnify, defend and hold Landlord and Landlord's Affiliates, excepting the City of San Diego, harmless from and against all liabilities, losses, demands, actions, expenses or claims, including reasonable attorneys' fees, fees of experts and accountants and court costs, for injury to or death of any person or for damages to any property arising out of or in any manner connected with: (i) the use, occupancy or enjoyment of the Project or Premises by Tenant and/or any sublessee and their agents, employees, invitees, licensees or contractors ("Tenant's Agents") or any work, activity or other things allowed by Tenant or Tenant's Agents to be done in or about the Project or Premises; (ii) any breach or default in the performance of any obligation of Tenant under this Lease; and (iii) to the extent allowed by law, any act or omission by Tenant or Tenant's Agents on or about the Project or Premises; provided, however, Tenant shall not be obligated to so indemnify Landlord or Landlord's Affiliates, excepting the City of San Diego, to the extent any such matters arise from or are caused by the acts or omissions of Landlord or Landlord's Affiliates, excepting the City of San Diego. If Tenant is required to defend Landlord, then Landlord may select its own defense counsel, and Tenant shall pay on behalf of, or to, Landlord all reasonable defense expenses incurred by Landlord. The indemnifications contained herein shall survive the expiration or earlier termination of this Lease.

(b) Landlord shall indemnify, defend and hold Tenant and Tenant's Agents harmless from and against all liabilities, losses, demands, actions, expenses or claims, including reasonable attorneys' fees, fees of experts and accountants and court costs, for injury to or death of any person or for damages to any property arising out of or in any manner connected with: (i) the use, occupancy or enjoyment of the Project or Premises by Landlord or Landlord's Affiliates, excepting the City of San Diego, or any work, activity or other things allowed by Landlord or Landlord's Affiliates, excepting the City of San Diego, to be done in or about the Project or Premises; (ii) any breach or default in the performance of any obligation of Landlord under this Lease; and (iii) to the extent allowed by law, any act or omission by Landlord or Landlord's Affiliates, excepting the City of San Diego, on or about the Project or Premises; provided, however, that Landlord shall not be obligated to so indemnify Tenant or Tenant's Agents to the

extent any such matters arise from or are caused by the willful misconduct or negligence of Tenant or Tenant's Agents. If Landlord is required to defend Tenant, then Tenant may select its own defense counsel, and Landlord shall pay on behalf of, or to, Tenant all reasonable defense expenses incurred by Tenant. The indemnifications contained herein shall survive the expiration or earlier termination of this Lease.

14. Assignment and Sublease. Tenant may assign this Lease, or sublease any portion of the Premises to any Tenant-related entity, subsidiary, or successor ("Affiliate"), without Landlord's consent, but with notice to Landlord. As to any person or entity that is not an Affiliate, Tenant shall not directly or indirectly, voluntarily or by operation of law, sublease, sell, assign, encumber, pledge or otherwise transfer or hypothecate all or any part of the Premises or this Lease, without the prior written consent of Landlord, which may be withheld by Landlord in its reasonable discretion; provided, however, that Landlord shall not unreasonably withhold, condition, or delay the approval of any proposed assignment or sublease. Any assignment or sublease shall be subject to all of the terms and conditions of this Lease. In no event shall any sublease, sale, assignment, encumbrance, pledge, transfer or hypothecation relieve Tenant of its obligations hereunder. Tenant shall remain primarily liable for performance of Tenant's obligations hereunder, whether this Lease is assigned, sublet and/or otherwise transferred, including without limitation the payment of Rent. No reasonable withholding of consent by Landlord shall give rise to any claim by Tenant or any proposed assignee, or entitle Tenant to terminate this Lease, to recover contract damages or to any abatement of Rent. Landlord shall not have a recapture right in the event of an assignment or sublease to an Affiliate or to a third-party assignee or sublessee. Landlord shall not have any profit participation in an assignment or sublease to an Affiliate or in the sublease of up to ten (10) individual offices to a third-party sublessee. In connection with any assignment or sublease of the Premises to a third-party sublessee not heretofore mentioned, as a condition to Landlord's consent, Tenant shall pay to Landlord as Rent as and when received by Tenant an amount equal to fifty percent (50%) of all "Profit" (as hereinafter defined) derived from such assignment or sublease. "Profit" shall mean the difference between (i) the sum of any and all amounts payable by the proposed assignee or sublessee under the terms of the proposed assignment or sublease, and (ii) the sum of the Rent and other payment obligations payable to Landlord by Tenant under the terms of this Lease, less Tenant's costs incurred and related to the sublease, including without limitation tenant improvements, commissions, downtime if vacant, legal expenses, and other leasing concessions. For all purposes under this Section 14, a sub-sublease, assignment of sublease or any similar arrangement shall be considered a sublease. Tenant understands and acknowledges that the intent of the parties in negotiating this Lease was not to create any bonus value or allow Tenant to profit as a result of any favorable terms contained herein or any future changes in the market for the Premises. Tenant further acknowledges that any such value shall be shared with Landlord as set forth in this Section 14. Landlord reserves the right to review and approve financial statements of all prospective assignees and to approve the form of the assignment and/or sublease involved in each transaction, as a condition to the approval of any and all assignments and subletting. Any assignment or sublease must be to a governmental entity or an Internal Revenue Code Section 501 (C)(3) entity, as required by the restrictions affecting the Premises and the Project.

15. Eminent Domain.

(a) Total Taking. If all or substantially all of the Premises are condemned or taken in any manner for public or quasi-public use, including without limitation a conveyance or assignment in lieu of the condemnation or taking, or if so much of the Premises is so taken or condemned so as to render the remaining portion of the Premises unusable by Tenant for the conduct of Tenant's business, as determined by the condemning authority, this Lease shall automatically terminate on the earlier of the date on which actual physical possession is taken by the condemner or the date of dispossession of Tenant as a result of such condemnation or other taking.

(b) Partial Taking. If less than all or substantially all of the Premises is so condemned or taken, rendering the remaining portion of the Premises usable by Tenant for the conduct of its business, as determined by the condemning authority, this Lease shall automatically terminate only as to the portion of the Premises so taken as of the earlier of the date on which actual physical possession is taken by the condemner or the date of dispossession of Tenant as a result of such condemnation or taking. If such portion of the Building is condemned or otherwise taken so as to require, in the opinion of Landlord, a substantial alteration or reconstruction of the remaining portions thereof, this Lease may be terminated by Landlord, as of the date on which actual physical possession is taken by the condemner or dispossession of Tenant as a result of such condemnation or taking, by written notice to Tenant within sixty (60) days following notice to Landlord of the date on which such physical possession is taken or dispossession will occur.

(c) Award. Landlord shall be entitled to the entire award in any condemnation proceeding or other proceeding for taking for public or quasi-public use, including without limitation any award made for the value of the leasehold estate created by this Lease. No award for any partial or total taking shall be apportioned, and Tenant hereby assigns to Landlord any award that may be made in such condemnation or other taking, together with any and all rights of Tenant now or hereafter arising in or to the same or any part thereof. Although all damages in the event of any condemnation shall belong to Landlord whether such damages are awarded as compensation for diminution in value of the leasehold or to the fee of the Premises, Tenant may claim and recover from the condemner, but not from Landlord, such compensation as may be separately awarded or recoverable by Tenant in Tenant's own right on account of damages to Tenant's business by reason of the condemnation and for or on account of any cost or loss which Tenant might incur to remove Tenant's personal property, including without limitation furniture, fixtures, and equipment, or for the interruption of or other damage to Tenant's business.

(d) Rent Abatement. In the event of a partial condemnation or other taking that does not result in a termination of this Lease as to the entire Premises, the Rent and all other charges shall abate in proportion to the portion of the Premises taken by such condemnation or other taking. If this Lease is terminated, in whole or in part, pursuant to any of the provisions of this Section 15, all Rent and other charges payable by Tenant to Landlord hereunder and attributable to the Premises taken shall be paid up to the date upon which actual physical possession is taken by the condemner or the date of dispossession of Tenant.

(e) Temporary Taking. If all or any portion of the Premises is condemned or otherwise taken for public or quasi-public use for a limited period of time, this Lease shall remain in full force and effect and Tenant shall continue to perform its obligations under this Lease; provided, however, the Rent and all other charges payable by Tenant to Landlord hereunder shall abate during such limited period in proportion to the portion of the Premises that is rendered unusable as a result of such condemnation or other taking. Landlord shall be entitled to receive the entire award made in connection with any such temporary condemnation or other taking.

(f) Transfer of Landlord's Interest to Condemner. Landlord may, without any obligation to Tenant, agree to sell and/or convey to the condemner the Premises, the Project, or any portion thereof, sought by the condemner, subject to this Lease and the rights of Tenant hereunder, without first requiring that any action or proceeding be instituted or, if instituted, pursued to a judgment.

16. Attorneys' Fees. If any action shall be instituted by either Landlord or Tenant for the enforcement or interpretation of any of its rights or remedies in or under this Lease, the prevailing party shall be entitled to recover from the losing party all costs incurred by the prevailing party in said action and any appeal therefrom, including reasonable attorneys' fees and court costs to be fixed by the court therein. The "prevailing party" shall be that party who obtains substantially the result sought, whether by settlement, dismissal, or judgment.

17. Default.

(a) Tenant's Default. The occurrence of any one or more of the following shall constitute a default hereunder by Tenant:

(1) Tenant abandons the Premises;

(2) Tenant is delinquent three (3) times within a twelve (12)-month period in paying any Rent or other charges required under this Lease;

(3) Tenant fails to promptly and fully perform any other of its obligations contained in this Lease and such failure continues for thirty (30) days (or such shorter time provided herein) after written notice thereof from Landlord; provided, however, that if the obligation to be performed by Tenant is of such nature that the same cannot reasonably be performed within thirty (30) days and if Tenant commences such performance within said thirty (30) day period and thereafter diligently undertakes to complete the same, then such failure shall not be a default hereunder. Such thirty (30) day notice shall be in lieu of and not in addition to any notice required under California Code of Civil Procedure Section 1161;

(4) A trustee, disbursing agent or receiver is appointed to take possession of all or substantially all of Tenant's assets or of Tenant's interest in this Lease and Tenant or any guarantor of Tenant's obligations under this Lease does not regain possession within sixty (60) days after such appointment; Tenant makes an assignment for the benefit of creditors; or all or

substantially all of Tenant's assets in, on or about the Premises or Tenant's interest in this Lease are attached or levied upon under execution and Tenant does not discharge the same within sixty (60) days thereafter;

(5) A petition in bankruptcy, insolvency or for reorganization or arrangement is filed by or against Tenant or any guarantor of Tenant's obligations under this Lease pursuant to any federal or state statute and, with respect to any such petition filed against it, Tenant or such guarantor fails to secure a stay or discharge thereof within sixty (60) days after the filing of the same;

(6) Immediately, in the event of any assignment, subletting or other transfer for which the prior written consent of Landlord has not been obtained;

(7) Immediately, in the event of discovery of any false or misleading statement concerning financial information submitted by Tenant and/or any guarantor of Tenant's obligations to Landlord in connection with obtaining this Lease or any other consent or agreement by Landlord;

(8) Immediately, in the event Tenant admits in writing its inability to pay its debts as they mature; or

(9) Immediately, upon the suspension of Tenant's right to conduct its business, caused by the order, judgment, decree, decision or other act of any court or governmental agency.

(b) Landlord's Remedies. Upon the occurrence of a default by Tenant that is not cured by Tenant within any applicable grace period, Landlord shall have the following rights and remedies in addition to all other rights and remedies available to Landlord at law or in equity:

(1) The rights and remedies provided by California Civil Code Section 1951.4, which allows Landlord to continue this Lease in effect and to enforce all of its rights and remedies under this Lease, including the right to recover rent and any other additional monetary charges as they become due, for as long as Landlord does not terminate Tenant's right to possession; provided, however, if Landlord elects to exercise its remedies described in this Section 17(b)(1) and Landlord does not terminate this Lease, and if Tenant requests Landlord's consent to an assignment of this Lease or a sublease of the Premises at such time as Tenant is in default, Landlord shall not unreasonably withhold its consent to such assignment or sublease. Acts of maintenance or preservation, efforts to relet the Premises or the appointment of a receiver upon Landlord's initiative to protect its interest under this Lease shall not constitute a termination of Tenant's right to possession:

(2) The right to terminate this Lease by giving notice to Tenant in accordance with applicable law;

(3) The right and power to enter the Premises and remove therefrom all persons and property, to store such property in a public warehouse or elsewhere at the cost of and

for the account of Tenant. Before retrieving any such property from storage, Tenant shall pay to Landlord, upon demand, all expenses incurred in such removal and all storage charges against such property. Any such property of Tenant not so retaken from storage by Tenant within thirty (30) days after such property is removed from the Premises shall be deemed abandoned and may be either disposed of by Landlord pursuant to Section 1988 of the California Civil Code or retained by Landlord as its own property. Landlord may from time to time sublet the Premises or any part thereof for such term or terms (which may extend beyond the Term) and at such rent and such other terms as Landlord in its sole discretion may deem advisable, with the right to make alterations and repairs to the Premises. Upon each such subletting, Tenant shall be immediately liable for payment to Landlord of the cost of such subletting and such alterations and repairs incurred by Landlord, if any. Any amounts received by Landlord from such subletting shall be applied first toward the cost of any alterations or repairs made to the Premises in connection with such subletting; second, to payment of Rent and other monetary obligations due and unpaid hereunder, and the residue, if any, shall be held by Landlord and applied in payment of future Rent and other monetary obligations as the same become due hereunder. If Tenant has been credited with any rent to be received by such subletting and such rent shall not be promptly paid to Landlord by the subtenant(s), or if such rents received from such subletting during any month are less than those to be paid during that month by Tenant hereunder, Tenant shall pay any such deficiency to Landlord. Such deficiency shall be calculated and paid monthly. No taking possession of the Premises by Landlord shall be construed as an election on Landlord's part to terminate this Lease unless written notice of such intention is given to Tenant. Notwithstanding any such subletting without termination, Landlord may at any time thereafter elect to terminate this Lease for such previous default;

(4) The right to have a receiver appointed for Tenant, upon application by Landlord, to take possession of the Premises and to apply any rent collected from the Premises and to exercise all other rights and remedies granted to Landlord pursuant to this Section 17; and

(5) The rights and remedies provided by California Civil Code Section 1951.2 to recover from Tenant upon termination of this Lease, including:

(A) the worth at the time of the award of the unpaid rent which had been earned at the time of termination;

(B) the worth at the time of the award of the amount by which the unpaid rent which would have been earned after termination until the time of the award exceeds the amount of such rental loss that Tenant proves could have been reasonably avoided;

(C) subject to subdivision (c) of California Civil Code Section 1951.2, the worth at the time of the award of the amount by which the unpaid rent for the balance of the Term after the time of the award exceeds the amount of rental loss that Tenant proves could be reasonably avoided; and

(D) any other amount necessary to compensate Landlord for all the detriment proximately caused by Tenant's failure to perform its obligations under this Lease or which in the ordinary course of things would be likely to result therefrom, including without

limitation reasonable attorneys' fees, reasonable broker's commissions and reasonable finder's fees (not only in connection with the reletting of the Premises, but also that portion of any leasing commission paid by Landlord in connection with this Lease which is applicable to that portion of the Term which is unexpired as of the date on which this Lease is terminated), reasonable costs for repairs, cleanup, refurbishing, removal (including the repair of any damage caused by such removal) and storage or disposal of Tenant's personal property, including without limitation equipment, and fixtures, and anything else Tenant is required by this Lease to remove but does not remove, and any costs for alterations, additions and renovations and any other costs and expenses incurred by Landlord in regaining possession of and reletting or attempting to relet the Premises.

.. (c) Worth at the Time of the Award. The "worth-at the time of award" of the amounts referred to in Section 17(b)(5)(A) and (B), above, shall be computed by allowing interest at ten percent (10%) per annum. The "worth at the time of award" of the amount referred to in Section 17(b)(5)(C), above, shall be computed by discounting such amount at the discount rate of the Federal Reserve Bank of San Francisco at the time of award plus one percent (1%).

(d) Mitigation of Damages. Landlord's obligation to mitigate damages after a default by Tenant under this Lease that results in Landlord regaining possession of all or part of the Premises shall be satisfied in full if Landlord undertakes to lease the Premises to a substitute tenant in accordance with the following criteria:

(1) Landlord shall have no obligation to solicit or entertain negotiations with any other prospective tenants for the Premises until Landlord obtains full and complete possession of the Premises including without limitation the final and unappealable legal right to relet the Premises free of any claim of Tenant;

(2) Landlord shall not be obligated to offer the Premises to any prospective tenant when other premises in the Building suitable for that prospective tenant's use are currently available, or will be available within three (3) months;

(3) Landlord shall not be obligated to lease the Premises to a substitute tenant for a rent less than the current fair market rent then prevailing for similar office space in comparable buildings in the same market area as the Building;

(4) Landlord shall not be obligated to enter into a new lease under terms and conditions that are commercially unreasonable;

(5) Landlord shall not be obligated to enter into a lease with any proposed substitute tenant that does not have, in Landlord's reasonable opinion, sufficient financial resources or operating experience to operate the Premises in a first-class manner;

(6) Landlord shall not be required to accept any substitute tenant offered by Tenant or to observe any instructions given by Tenant regarding such reletting;

(7) Landlord shall not be obligated to enter into a lease with any substitute tenant whose use would substantially negatively conflict with other tenants' uses in the Building; and

(8) Landlord shall not be required to expend any amount of money to alter, remodel, or otherwise make the Premises suitable for use by a substitute tenant, unless:

(A) Tenant pays any such sum to Landlord in advance of Landlord's execution of a lease with such substitute tenant (which payment shall not be in lieu of any damages or other sums to which Landlord may be entitled as a result of Tenant's default under this Lease); or

(B) Landlord, in Landlord's sole and absolute discretion, determines that any such expenditure is financially justified in connection with entering into any lease with such substitute tenant.

(e) Waiver by Tenant. Upon compliance with the criteria set forth in Section 17(d), above, regarding reletting of the Premises after a default by Tenant, Landlord shall be deemed to have fully satisfied Landlord's obligation to mitigate damages under this Lease; and Tenant waives, to the fullest extent legally permissible, any right to assert in any action by Landlord to enforce the terms of this Lease, any defense, counterclaim, or rights of setoff or recoupment respecting the mitigation of damages by Landlord, unless and to the extent Landlord maliciously or in bad faith fails to act in accordance with the requirements of this clause.

(f) No Waiver of Indemnification. Neither the termination of this Lease nor the exercise of any remedy under this Lease or otherwise available at law or in equity shall affect the right of Landlord to any right of indemnification set forth in this Lease or otherwise available at law or in equity for any act or omission of Tenant, and all rights to indemnification or other obligations of Tenant which are intended to be performed after termination of this Lease shall survive termination of this Lease and termination of Tenant's right to possession under this Lease.

(g) Landlord's Default.

(1) Default. It shall be a default of this Lease by Landlord if Landlord fails to perform any of its obligations under this Lease for a period of thirty (30) days after receipt of written notice thereof from Tenant; provided, however, that if the obligation is of such nature that the same cannot reasonably be performed within such thirty (30) day period, such default shall be deemed to have been cured if Landlord commences such performance within said thirty (30) day period and thereafter diligently undertakes to complete, and completes, the same.

(2) Tenant's Remedies. Except as may otherwise be provided in this Lease, Tenant shall not have the right based upon a default of Landlord to terminate this Lease or to withhold, offset or abate Rent. Tenant shall not have the right to terminate this Lease or to withhold, offset or abate the payment of Rent based upon the unreasonable or arbitrary withholding by Landlord of its consent or approval of any matter requiring Landlord's consent or

approval, including without limitation any proposed assignment or subletting; Tenant's remedies in such instance shall be limited to declaratory relief, specific performance, injunctive relief, and/or actual damages.

(3) Non-Recourse. Notwithstanding anything to the contrary contained in this Lease, Tenant shall look solely to the estate and property of Landlord in the Project for the enforcement of any judgment or other judicial decree requiring the payment of money by Landlord to Tenant by reason of any default or breach by Landlord in the performance of its obligations under this Lease, it being intended hereby that no other assets of Landlord or any of Landlord's Affiliates shall be subject to levy, execution, attachment or any other legal process for the enforcement or satisfaction of the remedies pursued by Tenant in the event of such default or breach.

(4) Limitation of Liability. In the event of a sale or transfer of the Premises, the person or entity defined as "Landlord" immediately prior to such transfer shall be automatically released from all personal liability for the performance or observance of any obligation of this Lease required to be performed by Landlord after the date of such transfer.

18. Signage. Tenant shall have standard Building and Project signage rights solely at Tenant's cost, which may be applied from the TI Allowance, if available. Any signage shall be in accordance with Landlord's signage plan and subject to Centre City Development Corporation's approval.

19. Quiet Enjoyment. Upon payment by Tenant of the Rent herein provided, and provided Tenant is not in default of this Lease, Tenant shall peaceably and quietly hold and enjoy the Premises for the Term without hindrance or interruption by Landlord or any other person or persons lawfully or equitably claiming by, through or under Landlord, subject to the terms and conditions of this Lease and any mortgage and/or deed of trust to which this Lease is subordinate and subject to Landlord's right from time to time to perform tenant improvement work in other space in the Project involving without limitation construction noise, the use of scaffolding, delays in the use of the Building's elevators, the presence of work crews and the use of the Building's elevators by work crews; provided such work does not unreasonably interfere with Tenant's use of the Premises.

20. Landlord Exclusive Control.

(a) Building Alterations. Landlord shall have sole and exclusive control of the Project, as well as the right to make changes to the Project, provided the same does not negatively impact the Project or Premises or Tenant's use, occupancy, and enjoyment thereof or Tenant's rights under this Lease. Landlord may, but shall not be obligated to: (i) restrain the use of the Project by unauthorized persons; (ii) utilize from time to time any portion of the Project (except the Premises without Tenant's prior written consent) for promotional and related matters; (iii) temporarily close any portion of the Project (except the Premises without Tenant's prior written consent) for repairs, improvements or alterations; (iv) change the shape and size of the Project (except the Premises without Tenant's prior written consent); or (v) change the location of improvements within the Project (except the Premises without Tenant's prior written consent).

including without limitation parking structures and other parking facilities, roadways, and curb cuts. Landlord may determine the nature, size, and extent of the common areas as well as make changes to the common areas from time to time which, in Landlord's opinion, are deemed desirable provided the same does not negatively impact the Project or Premises or Tenant's use, occupancy, and enjoyment thereof or Tenant's rights under this Lease.

(b) Landlord's Rights. Landlord may install, use, maintain, repair, relocate, and replace pipes, ducts, conduits, wires, and appurtenant meters and equipment included in the Premises or outside the Premises, change the boundary lines of the Project and install, use, maintain, repair, alter, or relocate, expand and replace any common areas. Such rights of Landlord shall include, without limitation, temporarily designating from time to time certain portions of the common areas as exclusively for the benefit of certain tenants in the Project.

21. Parking.

(a) Parking Validations. Tenant shall have the right to purchase fifteen (15)-minute parking validations based on the below-stated unreserved monthly rates throughout the first ten (10) years of the Term. During any extension of the Term as provided in this Lease, the price for such parking validations shall be the same as such then-current unreserved monthly parking rates. Validations shall be used only during Normal Business Hours.

(b) Tenant Parking. Landlord shall provide Tenant with forty (40) unreserved parking spaces beginning on the Commencement Date and for use throughout the Term, at prices and costs in addition to the Rent charged for the Premises. Said cost for each space is as described in this Section 21.(b). Tenant may rent up to twenty (20) additional unreserved parking spaces throughout the Term with ninety (90) days prior written notice. Tenant shall pay for parking at the rate of One Hundred Twenty-Five Dollars (\$125) per space, per month, fixed for the first ten (10) years of the Term. Tenant may, at Landlord's discretion, reserve tandem parking spaces at the rate of One Hundred Ten Dollars (\$110) per space, per month, fixed for the first ten (10) years of the Term. All parking spaces shall be available for Tenant's use twenty-four (24) hours per day, seven (7) days per week, and fifty-two (52) weeks per year. Parking rates payable by Tenant during any extension of the Term as provided in this Lease shall not exceed the prevailing rates for comparable parking within the Project's market area.

(c) Use of Parking Spaces. All parking shall be on the terms and conditions set forth in any parking rules and regulations established by Landlord (the "Parking Rules and Regulations"). Landlord may establish such additional reasonable rules and regulations as may be deemed desirable, at Landlord's sole discretion, for the proper and efficient operation and maintenance of the Garage. Nothing contained in this Lease shall be deemed to impose liability upon Landlord for personal injury or theft, for damage to any motor vehicle, or for loss of property from within any motor vehicle, which is suffered by Tenant or any of its employees, customers, service suppliers, or other invitees in connection with their use of parking spaces in the Garage or elsewhere.

(d) Landlord Control of Garage. Landlord shall at all times have the sole and exclusive control of the Garage, and may at any time exclude and restrain any person from use or

occupancy thereof. The rights of Tenant and its employees shall at all times be subject to: (i) the rights of Landlord and other tenants in the Building to use the same in common with Tenant and its employees; (ii) the availability of parking spaces in the Garage; and (iii) Landlord's right to change the location of any assigned reserved parking spaces, in Landlord's sole discretion.

22. Roof Rights. Tenant shall have the right, without rental or other charge, to use its pro-rata share of the roof of the Building, to the extent reasonably practicable, to install, operate, and maintain telecommunications antennas, microwave dishes, television satellite dishes, and other communications equipment, subject to such screening as may be required by the Landlord and/or governmental or quasi-governmental entities, including CCDC. Such use shall be subject to receipt of all required governmental approvals and shall not unreasonably interfere with the Building and/or Project systems and shall not adversely affect the roof and/or the roof warranties provided to Landlord.

23. Access and Security. Tenant and Tenant's employees shall have access to the Premises, Building, and Garage twenty-four (24) hours per day, seven (7) days per week, and fifty-two (52) weeks per year. The Building and Garage shall be equipped with a card-key controlled access system for after-hours access.

24. Subordination. Tenant's leasehold interest hereunder shall be subordinate to any mortgages now on, or hereafter to be placed on, the Premises. Tenant shall comply with reasonable requests of Landlord's lenders, for execution of documentation to effect such subordination of Tenant's leasehold interest, including without limitation subordination, non-disturbance, and attornment agreements. Tenant shall obtain any and all non-disturbance agreements in favor of Tenant from the holders of all mortgages, deeds of trust, ground leases and other encumbrances against the Project that Tenant, in its sole discretions, deems necessary.

25. Estoppel Certificates. Tenant, at any time and from time to time, upon not less than ten (10) days prior written notice from Landlord, shall execute and deliver to Landlord in a timely manner a statement evidencing the status of this Lease by: (a) certifying that this Lease is unmodified and in full force and effect, or, if modified, stating the nature of such modification and certifying that this Lease, as so modified, is in full force and effect and the date to which the Rent and other charges are paid in advance, if any; and (b) acknowledging that there are not, to Tenant's knowledge, any uncured defaults on the part of Landlord hereunder, or specifying such defaults if they are claimed.

26. Financial Statements. Landlord has reviewed financial statements if so requested of Tenant and has relied upon the truth and accuracy thereof with Tenant's knowledge and representations of the truth and accuracy of such statements and that said statements accurately and fairly depict the financial condition of Tenant as of the Effective Date. Said financial statements are an inducing factor and consideration for the making of this Lease by Landlord with Tenant. Tenant shall, at any time and from time to time upon not less than thirty (30) days prior written notice from Landlord, furnish Landlord with Tenant's most current financial statements which accurately reflect Tenant's then financial condition.

27. Notices. Each notice required or permitted by this Lease shall be in writing and delivered in person to the other party or by a nationally recognized overnight courier such as FedEx, or United States Certified Mail, Return Receipt Requested, postage fully prepaid, to the addresses set forth below or to such other address as either party may designate in writing and deliver as provided in this Section.

Landlord: SAN DIEGO HOUSING COMMISSION
1122 Broadway, Suite 300
San Diego, CA 92101

Copy to: CHRISTENSEN & SPATH LLP
550 West C Street, Suite 1660
San Diego, CA 92101

Tenant: THE CITY OF SAN DIEGO
Attn: Real Estate Assets Department
1200 Third Avenue, Suite 1700
M. S. 51A
San Diego, CA 92101

Copy to: SAN DIEGO CITY ATTORNEY
Attn: Real Property Section
1200 Third Avenue, Suite 1100
San Diego, California 92101-4106

28. Brokers. Landlord and Tenant each represents and warrants that except for CBRE, in the case of Landlord, and Studley, Inc., a New York corporation ("Studley"), in the case of Tenant, no broker has been involved in the negotiation or consummation of this Lease. Tenant and Landlord each agree to indemnify, defend (with an attorney of the indemnitee's choice) and hold the other harmless from and against all claims, demands, causes of action and liabilities, including without limitation reasonable attorneys' fees and costs, arising out of a claim for a commission by any other broker purporting to have acted on behalf of the indemnifying party.

29. Commission to Tenant's Agent. Landlord shall pay Studley, as Tenant's representative, a commission pursuant to a separately negotiated agreement between Landlord and Studley.

30. Force Majeure and Landlord Delay. Neither party shall be required to perform any obligation under this Lease so long as such performance is delayed or prevented by force majeure, which shall mean any acts of God, material restriction by any governmental authority (except for the City of San Diego, unless a state of emergency exists), civil riot, and any other cause not reasonably within the control of such party and which by the exercise of due diligence such party is unable, wholly or in part, to prevent or overcome.

31. Holdover. Tenant may hold over beyond the expiration of this Lease for a period of up to three (3) months ("Initial Holdover Period") on a per diem basis under all the same terms and conditions of this Lease, including rental rate, by providing Landlord with ninety (90) days prior

written notice. Occupancy after the Initial Holdover Period shall be on a month-to-month basis at one hundred twenty five percent (125%) of the Base Rent in effect at the end of the Initial Holdover Period.

32. Right of First Offer. Tenant shall have a continuous right of first offer ("Right of First Offer") to lease contiguous space on every floor occupied by Tenant ("Offer Space"). The Offer Space shall be submitted to Tenant under the same size, terms, and conditions that Landlord would propose to an interested third party. Tenant shall have ten (10) business days after receipt of said notice in which to elect to exercise its Right of First Offer. If Tenant fails, refuses or is unable to exercise said Right of First Offer, Landlord may lease the Offer Space to any third party. All rights associated with the Right of First Offer are personal to Tenant.

33. Contingencies. Notwithstanding the execution and delivery of this Lease, this Lease shall not be binding on either party unless and until both: (1) the Housing Authority of the City of San Diego approves and authorizes it; and (2) the City Council of The City of San Diego enacts an ordinance approving and authorizing the same.

34. General Conditions.

(a) Counterparts. This Lease may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

(b) Captions. The captions in this Lease are inserted for convenience of reference and in no way define, describe, or limit the scope or intent of this Lease or any provision of this Lease.

(c) Partial Invalidity. Any provision of this Lease which is unenforceable, invalid, or the inclusion of which would adversely affect the validity, legality, or enforcement of this Lease shall have no effect, but all the remaining provisions of this Lease shall remain in full effect.

(d) No Third-Party Rights. Nothing in this Lease, express or implied, is intended to confer any rights or remedies upon any person, other than the parties to this Lease and their respective successors and assigns.

(e) Time of Essence. Time is of the essence in this Lease.

(f) Relationship. Nothing contained in this Lease shall be deemed or construed by the parties or by any third person to create a relationship of principal and agent or partnership or a joint venture between Landlord and Tenant or between either or both of them and any third party.

(g) Landlord Approval. Where this Lease refers to an action or approval of Landlord, it shall mean the approval of the President/CEO of the San Diego Housing Commission, or designee, unless otherwise provided.

(h) Tenant's Approval. Whenever required or permitted under this Lease, Tenant's consent or approval shall mean the written consent or approval of the City Manager of San Diego, or his or her designee ("City Manager"), unless otherwise expressly provided. Tenant's discretionary acts hereunder shall be made in the City Manager's discretion, unless otherwise expressly provided.

(i) San Diego's Strong Mayor Form of Governance. All references to "City Manager" in this Lease shall be deemed to refer to the Mayor of San Diego or his or her designee. This section shall remain in effect for the duration Tenant operates under the mayor-council (commonly referred to as "strong mayor") form of governance pursuant to Article XV of The City Charter of the City of San Diego, California.

(j) Exhibits Incorporated. All exhibits referred to in and attached to this Lease are hereby incorporated in this Lease.

(k) Further Assurances. Landlord and Tenant shall execute and deliver all such instruments and documents and to take all actions reasonably required by this Lease or otherwise to accomplish its intent.

(l) Entire Agreement. This Lease contains the entire understanding of the parties. There is no other written or oral understanding between the parties with respect to this Lease or the Premises. Each party has relied solely on advice from its own attorneys and experts in entering into this Lease. No other party, agent, or attorney of any other party has made any promise, representation, or warranty whatsoever which is not contained in this Lease. No modification, amendment, or alteration of this Lease shall be valid unless it is in writing and signed by all parties hereto.

(m) No Continuing Waiver. No waiver by either party of any provision, breach, or default of this Lease shall be deemed a waiver of any other provision, the same provision in another instance, or any subsequent breach or default hereof. Landlord's consent to or approval of any act shall not be deemed to render unnecessary the obtaining of Landlord's consent to or approval of such act in another instance. No waiver by either party shall be effective unless it is in writing and signed by the waiving party.

(n) Consents. All consents to be given by either party shall be reasonably and timely given.

(o) Leasehold Mortgages. Tenant shall not encumber its leasehold interest in the Premises without Landlord's prior written approval.

(p) Nondiscrimination. There shall be no discrimination against or segregation of any person or group of persons, on account of race, color, creed, religion, sex, sexual orientation, marital status, national origin or ancestry in the leasing, subleasing, renting, transferring, use, occupancy, tenure or enjoyment of the Premises, nor shall Tenant itself, or any person claiming under or through it, establish or permit such practice or practices of discrimination or segregation

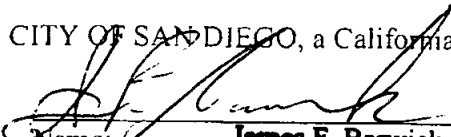
with reference to the selection, location, number, use or occupancy of tenants, lessees, sublessees, subtenants or vendees in the Premises.

(q) Signature Authority. Each individual signing this Lease for a party which is a corporation, limited liability company, partnership or other legal entity, or signing under a power of attorney, or as a trustee, guardian, conservator, or in any other legal capacity, represents and warrants to each other party hereto that they have the necessary capacity and authority to act for, sign and bind the respective entity or principal on whose behalf they are signing.

IN WITNESS WHEREOF, this Lease is executed to be effective as of the Effective Date.

TENANT:

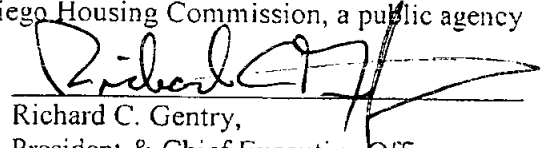
THE CITY OF SAN DIEGO, a California municipal corporation

BY: 

Name: James F. Barwick, CCLP
Title: Director, Real Estate Assets

LANDLORD:

San Diego Housing Commission, a public agency

BY: 

Richard C. Gentry,
President & Chief Executive Officer

APPROVED AS TO FORM AND LEGALITY:

JAN I. GOLDSMITH, San Diego City Attorney

BY: 

Name: Brock Ladewig
Title: Deputy City Attorney

CHRISTENSEN & SPATH LLP

BY: 

Charles B. Christensen, General Counsel
San Diego Housing Commission

EXHIBIT A: Premises Floor Plan
EXHIBIT B: Plans and Specifications

EXHIBIT "A"
Premises Floor Plan

Exhibit A: Premises Floor Plan

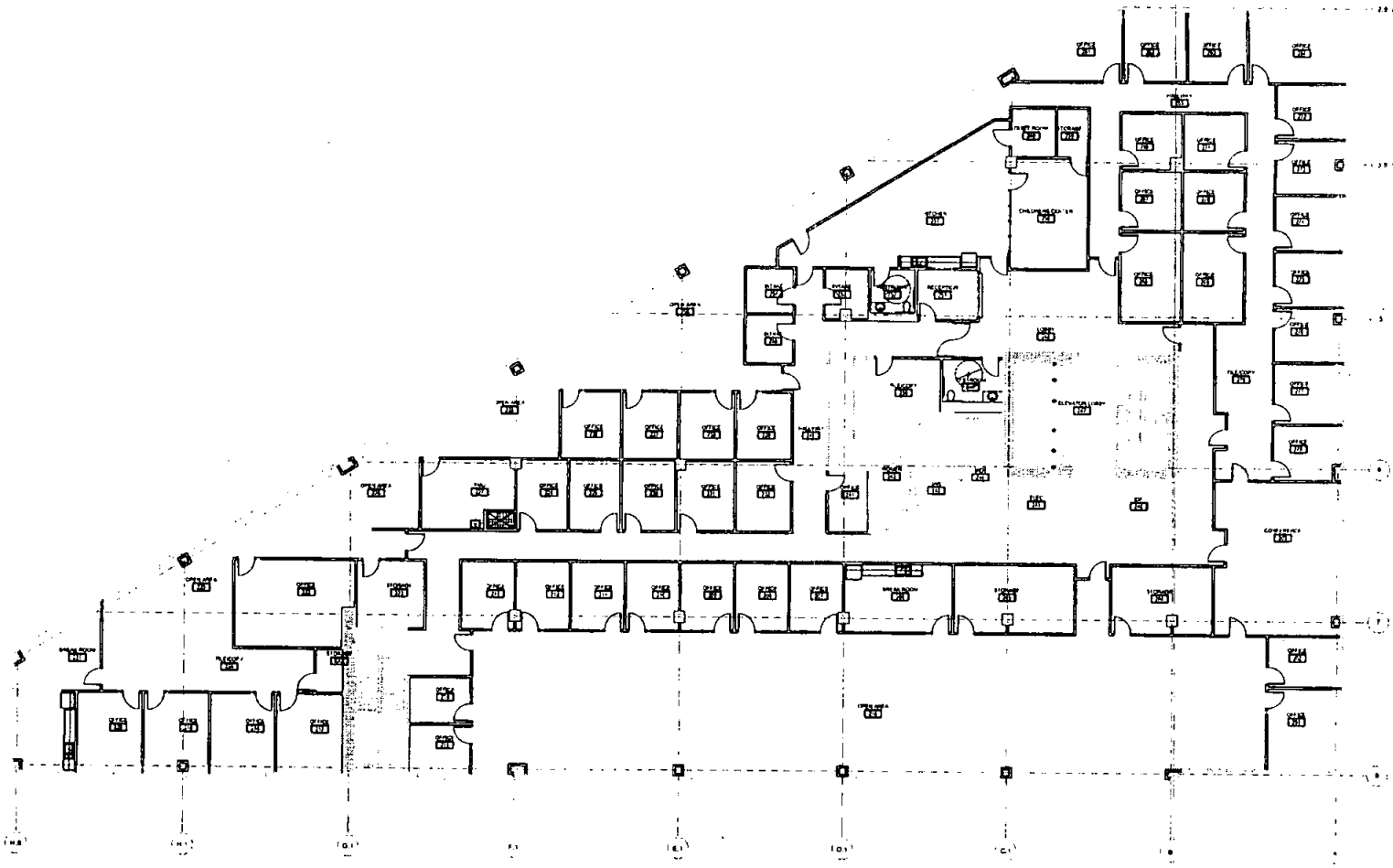


EXHIBIT A - PREMISES FLOOR PLAN

SCALE: 1" = 30'
February 12th, 2010

EXHIBIT “B”
Plans and Specifications

EXHIBIT 'B'

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

- A. The work of this Contract comprises construction of San Diego Housing Commission Tenant Improvements at Smart Corner for the Housing Opportunities Collaborative (HOC), the Employment Development Academy (EDA), the Family Justice Center (FJC) and Controls.
- B. Contractor shall obtain and pay for the use of work, storage, and parking areas needed.
- C. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage areas to designated areas.

SECTION 01210 – ALLOWANCES

- A. This Section includes administrative and procedural requirements governing allowances.
- B. Selection and Purchase:
 - 1. At the earliest practical date after award of the Contract, advise the Owner of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the work.
 - 2. At the Owner's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the work.
 - 3. Purchase products and systems selected by the Owner.
- C. Unused Materials: Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.
 - 1. When requested by the Owner, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.
- D. Schedule of Allowances:
 - 1. Audio/Visual:
 - a. EDA: \$100,000.
 - 2. Security:
 - a. EDA: \$100,000. Coordinate with other building systems.
 - 3. Non-code Required Signage:
 - a. HOC/EDA: \$20,000.
 - 4. Fire Sprinkler System, includes Permits and Fees:
 - a. HOC/EDA: \$23,200.
 - b. FJC: \$39,200.
 - 5. Fire Alarm System, includes Permits and Fees:
 - a. HOC/EDA: \$6,692.
 - b. FJC: \$11,308.
- E. Payment of Allowances: Application for payment of each item in the Schedule of Allowances must include full documentation of price paid, materials ordered and materials delivered. In the event the price paid is less than the Allowance, a change order will be generated to adjust the Allowance value.

SECTION 01250 – SUBSTITUTION PROCEDURES

A. Product Substitutions:

1. For products indicated or specified only by reference standard, select any product meeting such standard.
2. For products indicated or specified by naming several products or manufacturers, select any one of the products or manufacturers named or submit a request for substitution for a product or manufacturer not specifically named.
3. In requesting approval of a substitution, the Contractor represents that the proposed product has been evaluated and determined to be equal or superior to the product indicated or specified, the same guarantees/warranties or bonds will be provided for the substitution as for the product indicated or specified, the installation of an approved substitution will be coordinated into the work, and other changes required will be made to complete the work in compliance with the Contract Documents and applicable regulatory requirements, and claims for additional costs associated with the substitution, which may subsequently become apparent, will not be made.
4. The Owner will review requests for substitutions with reasonable promptness and notify the Contractor in writing of the decision to accept or reject the proposed substitution. The Owner will determine the acceptability of proposed substitutions, and a determination will be final.
5. Acceptance of a substitution shall not relieve the Contractor from responsibility for the proper execution of the work and other requirements of the Contract Documents.
6. If a substitution is not accepted, use the product specified or indicated. Do not purchase or incorporate substitutions in the work without the Owner's prior written approval. Substitutions installed or constructed without Owner's prior written approval shall be removed and placed with approved items at Contractor's cost and expense. No extension of Contract time will be provided for corrections due to unapproved substitutions.

SECTION 01290 – PAYMENT PROCEDURES

A. Requests for Payment: All requests for progress payments and final payment shall be prepared and submitted to the Owner in accordance with the General Conditions and other related Sections of the Contract Documents and shall utilize the forms and formats as identified and provided by the Owner.

1. Required Forms: Forms required for submittal of payment requests will include, but not be limited to:
 - a. HUD-51000 – Schedule of Amounts for Contract Payments.
 - b. HUD-51001 – Periodic Estimate for Partial Payment.
 - c. HUD-51002 – Schedule of Change Orders.
 - d. HUD-51003 – Schedule of Materials Stored.
 - e. HUD-51004 – Summary of Materials Stored.
2. Submission of Requests: Contractor shall familiarize himself with the required forms and procedures and submit requests in a complete and timely manner. Owner will not make progress payments or final payment without complete and properly executed paperwork.
3. Final Payment: Contractor shall make application for final payment only after the final punch list items have been completed to the Owner's satisfaction.

- B. Change Orders: Backup data submitted with Requests for Payment will be used as basis for approving or rejecting costs submitted in Change Orders. Submit an estimated cost breakdown for each Change Order request in accordance with the General Conditions and other related Sections of the Contract Documents. Utilize the forms and formats as identified by the Owner.
- C. Refer to the General Conditions, Special Conditions and other Sections of the Contract Documents for additional guidance and requirements.

SECTION 01312 - PROJECT MEETINGS

- A. Preconstruction Conference: Prior to commencement of work, the Owner will arrange for a preconstruction conference to be held to discuss and clarify administrative procedures to be followed during the progress of the work.
- B. Progress Meetings: Prepare Agenda, schedule and hold weekly meetings during the progress of the work. Take and distribute meeting notes to the attendees. Attendees taking exception to anything in the meeting notes shall state their objections in writing, within 5-working days following receipt.
- C. Billing Meetings: As part of the last progress meeting of each month, schedule and hold a billing meeting with the Owner's Project Representative in attendance, to agree on the percentage of the work completed up to that date and establish the amount to be requested in the Application for Payment.
- D. Guarantees/Warranties, Bonds, and Service and Maintenance Contracts Review Meeting: Eleven months following date of final acceptance, hold a meeting to review guarantees/warranties, bonds, and service and maintenance contracts for materials and equipment. Implement repair or replacement of defective items, and extend service and maintenance contracts, as desired by Owner.
- E. Refer to the General Conditions, Special Conditions, and other Sections of the Contract Documents for additional guidance and requirements.

SECTION 01330 – SUBMITTAL PROCEDURES

- A. Timing: Make submittals within the specified time, in advance of scheduled dates of installation to provide time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery.
- B. Completeness: Submittals shall be complete. Partial submittals will be rejected for not complying with the provisions of the Contract Documents.
- C. Schedules: Submit all required schedules on or before the date of the pre-construction meeting, unless otherwise specified.
 - 1. Progress Schedule: To be submitted for Owner's review and approval.
 - 2. Schedule of Amounts: Contractor shall be required to present a detailed Schedule of Amounts for Contract Payments form for each segment of the work as identified below. The schedule will list the installed value of the component parts of the work broken down into sufficient detail to serve as the basis for computing values for progress payments. One schedule shall be submitted for each of the following portions of the work:
 - a. Master Schedule of Amounts for Contract Payments, incorporating or "rolling up" all values from all other Schedules of Amounts.
 - b. Housing Opportunities Collaborative (HOC).
 - c. Employment Development Academy (EDA).
 - d. Family Justice Center (FJC).
 - d. Controls.

3. Submittal Schedule: Include submittal date for each submittal required by the Contract Documents. Submit on or before the date of the pre-construction conference for Owner's review and approval.
- D. Shop Drawings, Product Data, Samples and Other Submittals: Submit as required by the various Specification Sections. Allow a minimum of 10-working days for processing by the Owner.
1. Shop Drawings: Submit prints to the Owner. The Owner will review the Shop Drawings; mark a copy with required revisions and return the copy. Review the returned copy and take appropriate action as indicated. Revise and resubmit rejected submittals. Following final action by the Owner, distribute as required for accomplishment and inspection of the indicated work.
 2. Product Data: Submit in the quantity required to be returned, together with three copies each of brochures, catalog cuts, and similar material.
 3. Samples: Submit in the size specified in the individual Specification Sections, and in the quantity required to be returned, together with one additional Sample, which will be retained by the Owner. Where Samples have natural variations in texture, color, or dimension, submit Samples showing the range of variation.
- E. Patterns and Colors: Unless the exact pattern and color of a product are indicated in the Contract Documents, submit accurate color and pattern charts to the Owner for review and selection.

SECTION 01420 - REGULATORY AND REFERENCE STANDARDS

A. Regulatory Requirements:

1. Unless otherwise indicated or specified, perform the work in conformance with the latest edition of applicable regulatory requirements.
2. The codes adopted by the City, County, State and Federal agencies shall govern minimum requirements for this Project.
3. Conflicting Requirements:
 - a. Between Referenced Regulatory Requirements: Comply with the one establishing the more stringent requirements.
 - b. Between Referenced Regulatory Requirements and Contract Documents: Comply with the one establishing the more stringent requirements.

B. Reference Standards:

1. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.
2. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.
3. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, the more stringent quantity or quality level shall apply. The determination as to which of the conflicting standards is more stringent shall be at the Owner's sole discretion.
4. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Owner for a decision before proceeding.

5. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity.
6. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

SECTION 01450 - QUALITY CONTROL

- A. Testing Laboratory: An independent commercial testing organization shall be retained and paid for by the Contractor to perform tests and report on work as specified and as required. All costs associated with such testing will be reimbursed by the Owner.
- B. Contractor's Responsibilities: Cooperate with Testing Laboratory personnel, secure and deliver to the Testing Laboratory adequate quantities of representational samples of materials proposed for use for which testing is required, furnish copies of product test reports as required, and notify the Owner sufficiently in advance of operations to allow for testing Laboratory assignment of personnel and scheduling of tests.
- C. Retesting: If the Owner has reasonable doubt that materials comply with Specification requirements, additional tests shall be made as directed. If additional tests establish that materials comply with Specification requirements, costs for such tests will be paid by the Owner. If additional tests establish that materials do not comply with Specification requirements, costs for such tests shall be paid by the Contractor.

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

- A. Temporary Utilities: Furnish, install, and maintain temporary utilities as required to perform the work. Materials, installation, and maintenance of temporary utilities shall be in compliance with applicable regulatory requirements. Remove temporary utilities, including associated materials and equipment when no longer required. Restore and recondition areas of the site damaged or disturbed by temporary utilities or their installation. Remove and properly dispose of debris resulting from removal and reconditioning operations.
 1. Temporary Electric Power: Provide temporary power distribution.
 2. Temporary Heat and Ventilation:
 - a. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the work, to meet minimum conditions for the installation and curing of materials, and to protect materials and finishes from damage due to improper temperature and humidity conditions.
 - b. If permanently installed equipment is used during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.
 3. Temporary Water: Temporary water, for construction purposes and human consumption, is available at the Project site. The cost of the water will be paid by the Owner.
 4. Temporary Sanitary Facilities: Existing sanitary facilities on the second floor of the Project site are available for Contractor's conditional use during the performance of the work. It is the Contractor's responsibility to maintain the facilities in a neat, sanitary, fully functional and fully stocked condition throughout the entire performance of the work. Prior to the preparation of the final Punch List, it shall be the Contractor's responsibility to repair any and all damage to the facilities, clean and stock the facilities, and return the facilities to the Owner in a clean and like-new condition. All repairs shall be performed at Contractor's sole cost and expense and shall be completed to Owner's satisfaction.

5. Temporary Fire Protection: Provide and maintain fire extinguishers, fire hoses, and other equipment necessary for proper fire protection during the progress of the work. Equipment shall be designed for fire protection only.
- B. Construction Aids: Install and maintain construction aids as required by the performance of the work; relocate as required by the progress of the work. Remove construction aids when no longer required and clean and repair damage caused by installation and use. Restore permanent facilities used for temporary purposes.
1. Scaffolds and Platforms: Furnish, erect, and maintain scaffolds, guardrails, platforms, and similar temporary construction, necessary for the performance of the work.
 2. Temporary Enclosures and Protection of Work in Place: Provide temporary, weathertight enclosures as required for acceptable working conditions, weather protection for interior materials, effective temporary heating, and to prevent entry of unauthorized persons.
- C. Barriers and Enclosures: Provide and maintain suitable temporary barriers as required to prevent public entry; protect the work and persons from damage or injury from construction operations. Should regulatory requirements necessitate construction of temporary barriers, construct at no increase in Contract Sum.
1. Maintain temporary barriers in a structurally sound condition and neat appearance.
 2. Relocate as required by progress of the work. Restore and recondition site areas damaged or disturbed.
 3. Temporary barriers at the trolley station shall not limit trolley access or use.
- D. Security: Install temporary enclosure of partially completed construction areas to prevent unauthorized entrance, vandalism and theft. Secure temporary storage areas as required to prevent theft.
- E. Temporary Controls:
1. Noise and Vibration Control: Comply with applicable regulatory requirements for the operation of powered construction equipment. Equipment and impact tools shall have intake and exhaust mufflers.
 2. Secure written permission from Owner's Representative at least three working days prior to using noisy and vibratory equipment, such as jack-hammers, concrete saws, coring saws, impact tools, and high frequency electrical equipment. Cooperate with Owner's Representative if the use of noisy equipment becomes objectionable.
 3. Do not affect tenants occupying adjacent areas and floors of the building. Coring, saw-cutting and other noisy construction activities are not permitted during the hours of 8:00 a.m. and 5:00 p.m.
- F. Field Offices and Sheds: Furnish, install, and maintain field offices and sheds. Construct, install, and maintain field offices and sheds in compliance with applicable regulatory requirements. Portable or mobile buildings complying with the specified requirements may be used. Obtain Owner's approval for locations for field offices and storage sheds prior to commencing site preparation for the structures.
- G. Access to MTS Controlled Areas: Work hours affecting operation of the trolley on the East side of the building and any necessary permits shall be approved by Owner and coordinated with MTS. Any associated fees shall be paid by the Contractor and reimbursed by the Owner.
- H. Access to Building and Work Site:
1. Ingress and Egress: The property shall remain open and in use during the entire performance of the work. Adequate and safe ingress and egress shall be maintained at all times for all residents, employees and visitors. Contractor shall provide traffic and pedestrian plans, coordination, controls and management as required during staging, loading, delivery and waste removal. During any work that affects ingress or egress to the public parking garage, Contractor shall coordinate such work with garage operator.

2. **Building Stairwells:** During the performance of the work, the stairwell that exits to 1.1th Avenue will be available for Contractor's joint use with employees and visitors. It is the Contractor's responsibility to ensure the safety, cleanliness and good repair of the stairwell at all times. Stairwell is to remain unobstructed at all times during the Owner's normal business hours. Prior to the preparation of the final Punch List, it shall be the Contractor's responsibility to repair any and all damage to the stairwell and to return the stairwell to the Owner in a clean and like-new condition. All repairs shall be performed at Contractor's sole cost and expense and shall be completed to Owner's satisfaction. All other stairwells will "NOT" be made available for Contractor's use at any time during the performance of the work.
3. **Building Elevators:** The building elevators will "NOT" be made available for Contractor's use at any time during the performance of the work.
4. **Building Loading:** During the performance of the work, Contractor may request to open the building envelope at the second floor for loading, staging or equipment transport. The Owner may consider Contractor's request if made in writing to the Contracting Officer. Any such request must include, but not be limited to, the following:
 - a. Specific location opening is to be made and length of time opening will be present.
 - b. Written plan for the safety and protection of workers and pedestrians at both the second floor opening and at street level.
 - c. Detailed list of materials and finishes to be affected by opening including a written plan for the safety and protection of removed material, adjacent surfaces, and flatwork and landscaping at the street level.
 - d. Confirmation of strict compliance with original manufacturer's handling and installation specifications. Contractor shall provide documentation that existing materials and installation warranties have not been voided in any way by this work.

If any building loading encroaches on the sidewalk or street, Contractor shall secure and implement any and all necessary permits and safety precautions and shall do so at Contractor's sole cost and expense.

SECTION 01610 – COMMON PRODUCT REQUIREMENTS

- A. Material and equipment incorporated in the work shall be new, unless otherwise specified, in a condition acceptable to the Owner, and suitable for the intended use.
- B. **Transportation and Handling:** Deliver manufactured products in the manufacturers' original unbroken containers or packaging, with identifying labels intact and legible. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and reviewed submittals, and verify that products are properly protected and undamaged. Handle products and packages in a manner to avoid soiling or damaging. Promptly remove damaged or defective products from the site, and replace at no increase in Contract Sum.
- C. **Storage:** Store manufactured products in accordance with the manufacturer's instructions, with seals and labels intact and legible.

SECTION 01640 - OWNER-FURNISHED PRODUCTS

- A. This Section describes the requirements for the following:
 1. Providing utility and rough-ins and installing Owner-furnished products.
 2. Relocating existing products as indicated and specified.
 3. Provide utility, backing, and rough-ins as required for Owner-furnished and installed

products, including new Owner-furnished and installed furnishings and existing furnishings to be relocated by the Owner.

- a. HOC/EDA Furniture: Owner-furnished and Owner-installed.
- b. FJC Furniture: Tenant's existing to be relocated by the Tenant and installed by the Tenant.

4. Contractor shall coordinate the furniture schedule with the Owner and Tenant.

B. Contractor's Responsibilities:

- 1. Verify mounting and utility requirements for specified product items.
- 2. Provide mounting and utility rough-in for product items where required, regardless of responsibility designation.
 - a. Rough-in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.
 - b. If the Owner substitutes items similar to those scheduled, there shall be no change in rough-in cost, unless substitution occurs after rough-in has been completed or rough-in involves other mounting requirements, utilities or utilities of different capacity from that required by item originally specified.
- 3. Coordinate electrical requirements in installation scheduled.
- 4. For products designated to be Owner furnished, the Owner will make available manufacturer's literature or information and shop drawings showing required mounting and rough-in information.

C. Products furnished by the Owner, installed by the Contractor (OFCl):

- 1. The Owner and the Contractor will coordinate deliveries to coincide with construction schedule.
- 2. The Owner will furnish specified products with rough-in dimensions and characteristics indicated and tailgate deliver to the site.
- 3. The Contractor Shall:
 - a. Receive products at site and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Contractor shall assume responsibility for such defects and omissions.
 - b. Store products until ready for installation and protect from loss and damage.
 - c. Uncrate, assemble, and set in place.
 - d. Provide required backing plates.
 - e. Install products in accordance with manufacturer's recommendations, instructions, and shop drawings under supervision of manufacturer's representative where specified, supplying labor and material required and making mechanical, plumbing, and electrical connections required to operate products.

- D. Existing Products to be Relocated and Installed by the Contractor:
1. The Contractor Shall:
 - a. Remove products from present location when directed by the Owner or Architect.
 - b. Recap and label existing utilities at present location.
 - c. Store products as required and protect from loss and damage.
 - d. Relocate products to new location.
 - e. Install products, supplying labor and material required and making mechanical, plumbing, and electrical connections as required.
 - f. Patch or repair surfaces to match existing.
- E. Compatibility with Space and Service Requirements: Products shall be compatible with space limitations indicated and with mechanical and electrical services indicated and specified in other Sections. Modifications to products required to conform with space limitations or with utility services specified for rough-in shall not cause additional cost to the Owner.
- F. Manufacturer's printed descriptions, specifications, and instructions shall govern the work unless specifically indicated or otherwise specified.

SECTION 01740 - CLEANING

- A. Perform cleaning and disposal operations during the progress and completion of the work.
- B. Comply with applicable regulatory requirements during cleaning and disposal operations. Cleaning materials used shall comply with SCAQMD VOC limits.
- C. Perform cleaning operations as required during construction to prevent accumulations of dust, dirt, soil, and debris.
- D. Clean interior spaces prior to the start of finish painting and the application of other finishes, and continue cleaning as required until such work is completed.
- E. Schedule cleaning operations to prevent dust and other contaminants from adhering to wet or newly finished surfaces.
- F. Remove dust, dirt, grease, stains, fingerprints, labels, spilled and spattered, and other materials from interior and exterior surfaces exposed to view.
- G. Wash and shine glazing and mirrors.
- H. Polish glossy surfaces to a clear shine.
- I. Ventilating Systems: Replace air filters on ventilating units operated during construction. Clean ducts, blowers, and coils of units operated during construction.
- J. Vacuum and wipe insides of electrical panels and cabinetwork.
- K. Broom clean interior spaces and exterior paving.
- L. Rake clean ground surfaces.

SECTION 01742 - CONSTRUCTION WASTE MANAGEMENT

- A. Waste Management Requirements for the Project:

1. The Contractor is required to have daily waste removal from the Project site. Use of owner's on-site dumpster facilities will not be permitted at any time. On-street staged dumpsters are subject to City of San Diego approval and will be at Contractor's sole cost and expense including, but not limited to, dumpster fees, dump fees and permit fees.
2. The Owner has established that this Project shall minimize the creation of construction waste on the of job site. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination, shall be minimized. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.
3. Diversion Requirements: A minimum 50-percent of total project waste shall be diverted from landfill. The following waste categories, at a minimum, shall be diverted from landfill:
 - a. Clean dimensional wood, palette wood
 - b. Plywood, OSB and medium density fiberboard (MDF).
 - c. Cardboard, paper, packaging
 - d. Metals
 - e. Gypsum Drywall (unpainted)
 - f. Paint. Paint containers shall be reused or recycled.
 - g. Rigid Foam
 - h. Glass
 - i. Plastics
 - j. Carpet tile
 - k. Beverage containers
 - l. Insulation

SECTION 01770 – CLOSEOUT PROCEDURES

- A. Project Record Documents: Store Project documents and samples in field office apart from documents used for construction. Maintain Project documents in a clean, dry, legible condition and in good order. Do not use Project record documents for construction.
 1. Record information carefully and neatly, with felt tip pens, in color code designated, and in the manner approved in advance by the Owner.
 2. Record Drawings: Record the following kinds of information on black-line or blue-line prints:
 - a. Changes made by Change Orders and other modifications described in the General Conditions.
 - b. Locations of work concealed inside the building whose general location is changed from that shown on the Contract Documents.
 - c. Locations of items which have been changed, with the Owner's prior acceptance, from the locations indicated on the Contract Documents.

acceptance, from the locations indicated on the Contract Documents.

- d. Keep up to date during the entire progress of the work, and make available to the Owner. Furnish additional drawings necessary for clarification. Record deviations from the sizes, locations, and other features of installations shown in the Contract Documents. Give sufficient information to locate work concealed in the Building.
3. "As-Built" Drawings: At time of acceptance of the work and prior to final payment, using the record drawings for reference, prepare "As-Built" drawings on permanent, transparent, reproducible prints furnished by the Owner and paid for by the Owner. Employ a professional draftsman to prepare the "As-Built" drawings from the record drawings; record information in ink.
4. Specifications and Addenda: Mark each Specification Section to record manufacturer, trade name, catalog number, and supplier of each product and item of equipment incorporated in the work.
- B. Product Data: Furnish three copies of manufacturers' product data, specifications, installation instructions, and maintenance instructions for products incorporated in the work; information shall be for products in addition to equipment items requiring operating and maintenance data specified elsewhere in this Section. All product data pertaining to an item shall be assembled together.
- C. Operation Tests: Conduct operational tests as required to demonstrate that all systems have been completed and are in compliance with all requirements. Furnish a written record of test results using recording type instruments where applicable and as directed.
- D. Operating and Maintenance Data: Where maintenance manuals, record data, and operating instructions are specified, assemble in three ring plastic binders sized for 8-1/2- x 11-inch sheets.
- E. Instruction of Owner's Personnel: Where specified, furnish qualified personnel for on the job instruction of the Owner's operating and maintenance personnel. Where possible, furnish instruction, including special start-ups and running time, prior to occupancy of the building, including special start-ups and running time, at no additional cost to the Owner.
- F. Service and Maintenance Contracts: Compile, review, and submit specified service and maintenance contracts as specified for warranties and bonds.
- G. Preparation for Final Inspection:
 1. Perform final cleaning as specified in Section 01740.
 2. Assemble warranties, service and maintenance contracts, operating and maintenance instructions, and other items as specified, and submit to the Owner.
 3. Remove temporary tapes, wrapping, coatings, paper labels, and other similar items. Dust, mop, wash, or wipe exposed and semi-exposed surfaces.
 4. At the Contractor's request, the Owner will attend a pre-final detailed Project review, to allow the Contractor to gather the majority of punch list items while the Subcontractors are still on the Project. Provide a typewritten list of all items remaining to be completed or corrected; list by room number and item number. Segregate plumbing, HVAC, and electrical on separate lists.
 5. At the Contractor's request, the Owner will make a final Project review when the items in the pre-final punch list have been completed and final cleanup, operation tests and the like have been performed.
 6. When the Owner determines that the Project is substantially complete and that final punch list items are completed, a final Project Inspection Report will be executed.
 7. Upon execution of the Final Project Inspection Report, record and pay for Notice of Completion and furnish copies to the Owner.
- H. Restoration of Damaged Work: Restore or replace damaged materials and finishes caused

by movement of equipment or other operations as specified or directed by the Owner, at no additional cost to the Owner. Restoration shall be equal to the original work, and finishes shall match the appearance of existing adjacent work.

- I. Remedial Work: Replace work due to faulty workmanship or materials at no additional cost to the Owner. Coordinate work with the Owner and perform at such time and manner to cause minimal interruption and inconvenience to the Owner's operations.
- J. Extra Materials: Provide 5-percent extra finish materials and store where directed by the Owner. Delivery and certification of extra materials shall be prerequisite to Substantial Completion.
- K. Refer to the General Conditions, Special Conditions and other Sections of the Contract Documents for additional guidance and requirements.

SECTION 01783 – WARRANTIES

- A. Warranties: Manufacturers' warranties notwithstanding, warrant the entire work against defects in materials and workmanship for 12-months from the date of acceptance. Warranties between Contractor and manufacturers, and the Contractor and suppliers shall not affect warranties between the Contractor and the Owner. Submit the warranties typed on the Contractor's letterhead if for the entire work, or on the Subcontractor's letterhead if for the work of a Specification Section.

END OF DIVISION 1

SECTION 03393

SPRAY-APPLIED CONCRETE CURING COMPOUND

PART 1 - GENERAL

- 1.01 This Section includes spray-applied concrete surface treatment, applied to fresh concrete floor underlayment where access flooring is not used.
- 1.02 Warranty: Warranty failure of finish flooring system due to moisture vapor migration or moisture-borne contaminants for a period of 15-years from date of Substantial Completion. This warranty shall include labor and materials required to replace floor covering materials that fail due to moisture vapor emission and moisture born contaminants. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Creteseal "CS2000" Spray-Applied System, Sinak Corporation "VC5" or approved equal.
- 2.02 Material: ASTM C1315 Type 1, Class A and ASTM C309 Type 1, Class A, VOC-compliant penetrating product with no less than 34-percent solids content, leaving no sheen.

PART 3 - EXECUTION

- 3.01 Preparation: Do not highly burnish concrete slabs to receive spray-applied concrete curing compound. Do not dilute material with any other substance and do not use in spray containers contaminated with other products.
- 3.02 Apply spray-applied concrete curing compound the day of the concrete pour, as soon as weather permits, prior to any other chemical treatments for concrete.
- 3.03 Apply material as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain foot traffic without damage.
- 3.04 Spray-apply material at the rate of 200-sq. ft. per gallon. Broom product evenly over the substrate until product has completely penetrated the surface.
- 3.05 If product is over-sprayed on a painted, glass or metal surface, clean off immediately with clean cloth and water.

END OF SECTION

SECTION 03542

CONCRETE FLOOR UNDERLAYMENT

PART 1 - GENERAL

- 1.01 This Section includes concrete floor underlayment and self-leveling concrete floor underlayment where underfloor clearance doesn't permit the use of access flooring.

PART 2 - PRODUCTS

- 2.01 Concrete Underlayment: Ardex, Inc. "Ardex SD-P Instantpatch", Bonsai B-1 Leveler" or approved equal.
- 2.02 Self-Leveling Concrete Underlayment: Ardex, Inc. "Ardex K-15 Self-Leveling Underlayment Concrete", Bonsai "Self-Leveling Underlayment", Dayton Superior "LevelLayer I", Gyp-Crete "Level-Right", Quickcrete "Self-Leveling Floor Resurfacer" or approved equal.
- 2.03 Primer: As recommended by underlayment manufacturer.
- 2.04 Concrete Underlayment: Underlayment shall have a minimum compressive strength of 4,200-psi at 28-days. Underlayment shall be able to be installed from featheredge to 1-inch and up to 3-inches with aggregate. Minimum thickness shall be 1/8-inch.
- 2.05 Self-Leveling Underlayment: Underlayment shall have a minimum compressive strength of 4,000-psi at 28-days. Self-leveling underlayment shall be able to be installed from featheredge to any thickness in one pour.
- 2.06 Aggregate: Well-graded, washed gravel for use when underlayment is installed over 1-1/2-inch thick; size of aggregate as recommended by manufacturer.
- 2.07 Water: Clean and potable.

PART 3 - EXECUTION

- 3.01 Surfaces to receive underlayment shall be solid, clean and properly primed. Concrete subfloors shall be clean and free of oil, grease, dirt, curing compounds, and other items that may act as bond breakers. Mechanically clean if required using shot-blasting; acid etching is not acceptable. Wood subfloors shall be clean and free of foreign matter. Sand to bare wood and vacuum to remove dust. Re-nail loose boards.
- 3.02 Prime subfloor in accordance with manufacturer's recommendations. Do not leave any bare spots and remove puddles and excess primer. Do not apply underlayment until primer is dry.
- 3.03 Mix materials in accordance with manufacturer's instructions.
- 3.03 Place underlayment using a wood or magnesium float. When underlayment begins to harden, finish with a steel trowel. Pour or pump self-leveling liquid underlayment and spread in place. Comply with manufacturer's instructions.
- 3.04 Prohibit foot traffic until underlayment is dry.
- 3.05 When complete, underlayment shall be finished to a reasonably smooth and uniform condition, and be free from pin holes, gouges, cuts, and other damage or defects. Transition between finish surfaces of underlayment and adjacent existing flooring shall be free from offsets.

END OF SECTION

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

- 1.01 This Section includes interior architectural woodwork items.
- 1.02 WI Certified Compliance Program (CCP):
 - A. In the event of question as to compliance with the referenced standard of any item of work, the Architect may require independent inspection service of questioned items as specified in "Independent Inspection Service" of "WI Services and Quality Control Options" published by the WI.
- 1.03 Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

- 2.01 Provide materials that comply with requirements of the Architectural Woodwork Standards (AWS) for each type of woodwork and AWS quality grade specified.
- 2.02 Wood Moisture Content: Comply with requirements of referenced quality standards for moisture content of lumber in relation to relative humidity conditions existing at time of fabrication and in installation areas.
- 2.03 Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to a radius as follows:
 - A. Corners and edges of solid wood members less than 1-inch in nominal thickness: 1/16-inch.
 - B. Edges of rails and similar members more than 1-inch in nominal thickness: 1/8-inch.
- 2.03 Millwork for Opaque Finish:
 - A. Quality Standard: Comply with Architectural Woodwork Standards (AWS) Section 6, Custom Grade.
 - B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
 - C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
 - D. Lumber Species: White pine, sugar pine, or other closed-grain hardwood listed in referenced woodworking standard.
 - E. Finish: Field-applied as specified in Section 09900.

PART 3 - EXECUTION

- 3.01 Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.
- 3.02 Install interior architectural woodwork in accordance with Architectural Woodwork Standards (AWS) for same grade specified for woodwork involved.
- 3.03. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8-inch in 8'-0" for plumb and level.
- 3.04 Millwork: Install with minimum number of joints possible, using full-length pieces to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.
- 3.05 Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

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- 3.06 Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer, to ensure woodwork is without damage or deterioration at time of final acceptance.

END OF SECTION

SECTION 06410

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

- 1.01 This Section includes the following:
- A. Custom plastic laminate faced cabinetwork.
 - B. Plastic laminate countertops.
- 1.02 Materials and fabrication of cabinetwork shall be in accordance with the standards of the Architectural Woodwork Standards (AWS) for the grades specified.
- 1.03 WI Certified Compliance Program (CCP):
- A. Before delivery to the Project site, if the fabricator/supplier is:
 - 1. A WI licensee, issue WI "Certificates of Compliance" certifying that items comply with Architectural Woodwork Standards (AWS) requirements for specified grade.
 - 2. A non-WI licensee, furnish a WI "Certified Compliance Tracking Acknowledgement" with the original submittal, evidencing that they have arranged for and will pay inspections required by the WI to comply with the specified requirements. If fabrication and installation are in compliance with AWS standards, Certified Compliance labels will be affixed by the WI Inspector. After fabrication, stamp each piece of cabinetwork in an inconspicuous place with WI Compliance Grade Stamp.
 - B. Each elevation of casework and plastic laminate countertops shall bear the WI Certified Compliance Label indicating conformance to specified grade.
 - C. Upon completion of installation, furnish a WI Certified Compliance Certificate for the installation.
 - D. In the event of question as to compliance with the referenced standard of any item of work, the Architect may require independent inspection service of questioned items as specified in "Independent Inspection Service" of "WI Services and Quality Control Options" published by the WI.
- 1.04 Shop Drawings: Show details of fabrication and installation, dimensioned plans, elevations, and sections. Each set of shop drawings shall comply with Architectural Woodwork Standards (AWS) Section 1 - Submittals and shall bear the Woodwork Institute Certified Compliance Program Label on the first page. Photocopies of architectural drawings are not acceptable. Highlight any modifications to the Specifications or AWS requirements.
- 1.05 Environmental Limitations: Do not deliver or install cabinets until wet work is completed and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- 1.06 Do not use wood products containing urea formaldehyde glues inside the shell of the building. When machining plastic products, protect surrounding areas from dust.

PART 2 - PRODUCTS

- 2.01 High-Pressure Decorative Laminate (HPDL): Comply with Architectural Woodwork Standards (AWS) Section 4 and NEMA LD3.
- A. Horizontal Surfaces: HGS, 0.048-inch nominal thickness.
 - B. Vertical Surfaces: VGS, 0.028-inch nominal thickness.
 - C. Horizontal Post-formed Surfaces: HGP, 0.039-inch nominal thickness.
 - D. Cabinet Liner: CLS, 0.020-inch nominal thickness.

- E. Backer: BKL, 0.020-inch nominal thickness, complying with AWS Section 4 for casework Grade specified.
 - F. Manufacturer, Pattern, Sheen, Color: As indicated on the Finish Legend.
- 2.02 Low-Pressure Decorative Laminate (LPDL): Comply with Architectural Woodwork Standards (AWS) Section 4 and NEMA LD3. LPDL shall consist of melamine, polyester or foil resin-impregnated paper thermally fused under pressure to an approved core and have a balance sheet.
- 2.03 Balance Sheet: HPDL or overlay of a compatible thickness.
- 2.04 Hardboard: Manufactured of interfelted lignocellulosic fibers, consolidated under heat and pressure to a density of 31-pcf or greater, tempered grade, 1/4-inch-thick tempered, smooth both sides.
- 2.05 Backing for Plastic Laminate: One of the following, at Contractor's option.
- A. Medium Density Fiberboard:
 - 1. Dry Areas: Medite Corporation "Medite II" or approved equal (no known equal) medium density fiber board, 3/4-inch thick, 48-pcf density. Fiber board shall have a recycled content of 92-percent.
 - 2. Countertops with Sinks: Medite Corporation "Medex" or approved equal (no known equal) medium density fiber board, 3/4-inch thick, 48-pcf density. Fiber board shall have a recycled content of 92-percent.
 - B. Plywood: Architectural Woodwork Standards (AWS) Grade B close grain hardwood veneer plywood, smooth, well sanded, thickness indicated. Provide exterior grade with waterproof glue at countertops with sinks.
 - C. Particleboard: One of the following at Contractor's option:
 - 1. Roseburg Forest Products "SkyBlend Particleboard" or approved equal complying with ANSI A208.1, Grade M-2. Particleboard shall contain 100-percent pre-consumer recycled wood fiber. Do not use at countertops with sinks.
 - 2. Straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density. Do not use at countertops with sinks.
- 2.06 Subframe Lumber: No. 1 grade Douglas Fir or plain sawn Yellow Poplar.
- 2.07 Adhesives: Contact, semi-rigid or rigid adhesives as recommended by laminated plastic manufacturer.
- 2.08 Hardware:
- A. Hinges: 120-degree opening, concealed hinge, passing 100,000-cycle test. Provide three hinges on doors over 48-inches high.
 - B. Door and Drawer Pulls: Builders Brass Works No. 9054, Quality No. 812, Stanley 4483 or approved equal, satin stainless steel.
 - C. Door Locks: National Lock C8123, Corbin 0737, Olympus 100DR or approved equal. Key as directed by the Owner.
 - D. Drawer Locks: National C8138, Corbin 0738, Olympus 200DW or approved equal. Key as directed by the Owner.
 - E. Drawer Guides: Accuride, Blum, Grant, K&V or approved equal.
 - 1. Pencil Drawers: Minimum 50-pound capacity.
 - 2. General Purpose Drawers: Full extension, minimum 100-pound capacity.

- 3. File Drawers: Full extension, minimum 150-pound capacity; 200-pound capacity at lateral file drawers wider than 30-inches.
 - F. Adjustable Shelf Standard: Grant 120, K&V 255 or approved equal.
 - G. Adjustable Shelf Clips: Grant 21Z, K&V 256 or approved equal.
 - H. Plastic Grommets: Provide at penetrations through countertops. Size and color as approved by the Architect. Provide minimum two grommets per work station. Coordinate location with Owner.
- 2.09 Fabricate products in accordance with the approved Shop Drawings and specified Architectural Woodwork Standards (AWS) Grade requirements. The architectural drawings indicate form and profile concept only. Fabrication and construction details shall comply with AWS unless otherwise specified.
- 2.10 Fabricate laminated plastic casework in accordance with Architectural Woodwork Standards (AWS) Section 10, Custom grade, except as otherwise specified, Construction Type A – Frameless Construction; Interface Style 1 – Overlay.
- A. Exposed exterior portions shall be covered with a HPDL as specified.
 - B. Exposed interior surfaces, except at doors and drawer fronts shall be covered with a HPDL matching exposed exterior surfaces.
 - C. Exposed interior surfaces of door and drawer fronts shall be covered with the same material, pattern, color and thickness as the door face.
 - D. Edge Banding: HPDL, minimum 0.02-inch thick, color-matched to the exposed face.
 - E. Semi-exposed surfaces of cabinet tops and bottoms, cabinet ends, fixed and adjustable shelves, cabinet back, cabinet doors, and drawers shall be finished with a polyester laminate; exposed edges of semi-exposed surfaces shall be finished with extruded PVC or self-edged plastic laminate.
 - F. Door and Drawer Front Style: Flush overlay.
 - G. Door and Drawer Edge: Square edge with thin applied band.
 - H. Shelf Thickness: As specified in Architectural Woodwork Standards (AWS) for a uniform load of 50-lb./sq. ft.
- 2.11 Fabricate laminated plastic countertops in accordance with Architectural Woodwork Standards (AWS) Section 11, Premium grade.
- A. Countertop Splash Assembly Type: 2.
 - B. Countertop Edges: Self-edged with plastic laminate or hardwood trim as indicated.
 - C. Back Splash: Horizontal square butt joints or integral cove as indicated.
 - D. Top of Back Splash: Square with self edge.
 - E. Back Splash Height: As indicated.

PART 3 - EXECUTION

- 3.01 Install cabinetwork in accordance with Architectural Woodwork Standards (AWS) Premium Grade requirements.
- 3.02 Install products plumb and level. Securely fasten cabinetwork to supporting substrate as indicated. Anchor tops to base units and other supports as indicated. Seal space between backsplash and wall with sanitary sealant specified in Section 07920. Install with no more than 1/8-inch in 8'-0" sag, bow, or other variation from straight line.

- 3.03 Clean, lubricate and make final adjustments to hardware for proper operation. Clean cabinetwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- 3.04 Protect cabinetwork to ensure work will be without damage at time of Substantial Completion. Cover completed cabinetwork with 4-mil polyethylene film protective enclosure, applied in a manner to permit easy removal.

END OF SECTION

SECTION 06640

PLASTIC PANELING (FRP)

PART 1 - GENERAL

- 1.01 This Section includes fiberglass reinforced plastic (FRP) coated wall panels, trim, adhesive, and accessories.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Allied Resinous Products, Inc. "Permaclean", Kemlite "Fire-X Glasbord", Sequentia "Structoglas" or approved equal.
- 2.02 Typical Field Size: 48-inches wide x height indicated, 0.09-inch thick.
- 2.03 Color: As selected by the Architect.
- 2.04 Flame Spread / Smoke Developed: 25 or less / 450 or less, ASTM E84.
- 2.05 Adhesive: Waterproof adhesive as recommended by panel manufacturer for installation conditions.
- 2.06 Moldings: Aluminum. Provide inside corners, outside corners, edging, division strips, and base molding.
- 2.07 Sealant: As specified in Section 07920.

PART 3 - EXECUTION

- 3.01 Install panels in accordance with panel manufacturer's instructions using moldings and adhesive.
- 3.02 Before installing panels in moldings, fill grooves in moldings with silicone sanitary sealant specified in Section 07920.
- 3.03 When complete, panels shall be securely adhered to substrates and moldings shall be plumb and level. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, fingerprints, and other defects and damage.

END OF SECTION

SECTION 07142

ELASTOMERIC LIQUID WATERPROOFING

PART 1 - GENERAL

- 1.01 This Section includes cold fluid-applied waterproofing under thin-set floor tile in toilet rooms.
- 1.02 Warrant elastomeric liquid waterproofing to be free from defects in materials and workmanship for a period of 10-years from Date of Substantial Completion. This warranty shall include the cost to replace covering materials applied over cold fluid-applied waterproofing.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Laticrete International "Laticrete 9235", Mer-Kote Products, Inc. "Mer-Krete B.F.P. Waterproof Membrane" or approved equal.
- 2.02 Membrane: Cold-applied liquid rubber latex with fabric reinforcement.
- 2.03 Reinforcing: Rot-proof fabric, designed by membrane manufacturer for use in reinforcing membrane.

PART 3 - EXECUTION

- 3.01 Clean substrate of projections and substances detrimental to work; comply with recommendations of membrane manufacturer. Rough or uneven surfaces shall be made smooth or leveled with underlayment material in accordance with manufacturer's recommendations. Concrete surfaces shall be smooth, clean, free from dirt, grease, concrete sealers or curing compounds. Dry, dusty slabs shall be dampened and swept off.
- 3.02 Comply with ANSI A108.1, ANSI A108.13 and manufacturer's instructions.
- 3.03 Precut reinforcing fabric allowing 2-inches for overlap at ends and sides. Extend fabric 6-inches through door openings.
- 3.04 Reinforce Joints: Spread a layer of waterproofing liquid at joints and cracks. Imbed a 6-inch wide strip of reinforcing fabric into the liquid. Spread a layer of waterproofing liquid over the fabric to seal it.
- 3.05 Coves: Spread a layer of waterproofing liquid in coves, imbed fabric and allow 6-inches of the fabric to flash up to walls. Spread a coat of liquid over the fabric to seal it. Flash the fabric and waterproofing liquid into drains and around projections.
- 3.06 Cracks: Clean and fill cracks greater than 1/16-inch with a scratch coat of latex portland cement mortar and allow to cure. Spread a layer of waterproofing liquid on crack, imbed a 6-inch strip of reinforcing fabric into the liquid, and spread a coat of liquid over the fabric to seal it.
- 3.07 Using a paint roller or brush, apply a coat of liquid membrane to the floor and/or wall, slightly wider than the fabric width. Include joints and coves previously reinforced. While the surface is still wet, embed fabric and smooth out wrinkles and press with brush or roller until membrane bleeds through to surface.
- 3.08 Apply liquid membrane to completely cover the fabric and allow to dry to the touch.
- 3.09 Apply an additional coat of liquid membrane and allow to dry.
- 3.10 Inspect final surface for pinholes, voids or thin spots. Use additional membrane liquid to seal any defects.
- 3.11 Do not permit traffic on completed membrane prior to application of surfacing material.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 - GENERAL

- 1.01 This Section includes firestopping.
- 1.02 Firestopping materials shall conform to California Building Code (CBC) for fire resistance standards and requirements for penetrations in walls, partitions, and floor/ceiling and floor/roof assemblies.

PART 2 - PRODUCTS

- 2.01 Through-Penetration Firestopping Materials: Listed manufacturers of through-penetration firestopping are intended as guidelines only; manufacturer and material type shall be as required by the UL Design No. for each penetration to receive firestopping. Provide mortar, sealants and caulk, putty, wrap strips, pillows, bags, and other types required for UL Design No. for each penetration to receive firestopping.
- 2.02 Mineral Fiber Firestopping Materials: Semirigid mineral fiber insulation, minimum 4-pcf density; USG Interiors "Thermafiber Safing", Johns Manville "Insul-Shield", Thermal Ceramics Inc. "CeraBlanket F.S" or approved equal.
- 2.03 Firestopping at Electrical Boxes and Utility Outlets: Utility penetrations in walls, ceilings, or floors requiring protected openings shall be firestopped and sealed with an approved material securely installed, capable of maintaining its integrity when subjected to test temperatures specified in ASTM E814.
- 2.04 Firestopping at Metal Deck Flutes:
 - A. Steel Deck Insert: Fyre Sleeve Industries, Inc., "Q-Stop" or approved equal one-piece fire-retardant plug for steel deck flutes.
 - B. Fire-Rated Sealant: Grace Construction Products "FS-3000", Hilti "CP-672 Speedspray", 3M "Firedam Spray", Tremco "Tremstop Acrylic" or approved equal.
 - C. Mineral Wool: Minimum 4-pcf density as specified.

PART 3 - EXECUTION

- 3.01 Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.
- 3.02 Provide solid continuous firestopping wherever the penetration or addition of a construction element through or adjacent to a fire-rated floor, wall or partition, or roof creates a discontinuity of such a rated separation. Application limited in size and configuration to tested systems. Do not install insulation types specified in other Sections in lieu of specified firestopping materials.
- 3.03 Interior Walls and Partitions: Where top edge of a fire-rated wall or partition abuts a fluted-type metal deck, provide mineral fiber and fire-rated sealant to fill flute spaces for the full depth or width of the wall or partition.
- 3.04 Penetrations: Penetrations include conduit, cable, wire, pipe, duct, and other elements which pass through one or both outer surfaces of a fire-rated floor, roof, wall, or partition.
- 3.05 Fire Rated Partitions: Gaps exceeding 1/2-inch at smoke rated and fire-rated partitions shall be firestopped with a firestop sealant as listed in UL "Fire Resistance Directory" and as specified. Apply minimum 3/8-inch bead at intersection of finish material and adjacent surface, both sides and along entire perimeter. Intersections at fire-rated partitions and steel deck type floor-ceiling or roof-ceiling assemblies shall be firestopped as required.
- 3.06 Prepare and install firestopping in accordance with manufacturer's instructions.
- 3.07 Identify firestop systems after installation. Identify the firestop system that has been installed and include the appropriate UL Design Number.

- 3.08 Remove spilled and excess materials without damaging adjacent surfaces. Leave finished work in neat, clean condition with no evidence of spill-overs or damage to adjacent surfaces.
- 3.09 Waste Management: Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperatures. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

- 1.01 This Section includes joint sealants.

PART 2 - PRODUCTS

- 2.01 Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920 Type S; Grade NS; Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures; Dow Corning Corp. "786 Mildew Resistant", General Electric Co. "Sanitary 1700", Sonneborn Building Product Div. "Sonolastic Omniplus", Tremco Tremsil 200 or approved equal.
- 2.02 Horizontal Joint Sealant: Two-part pourable urethane; ASTM C920, Type M; Grade P; Class 25; Uses T, M, A and O; Pecora Corp. "NR-200 Urexpam", Sonneborn "Sonolastic Paving Joint Sealant", Tremco, Inc. "THC-900/901" or approved equal. Horizontal joint sealant shall have a minimum Shore A hardness of 30.
- 2.03 Interior Building Sealant: Acrylic-emulsion; one-part, nonsag, mildew-resistant, complying with ASTM C834, formulated to be paintable; Pecora Corp. "AC-20", Sonneborn "Sonolac", Tremco Inc. "Tremco Acrylic Latex 834" or approved equal.
- 2.04 Joint Filler: Preformed cork strips complying with ASTM D1752 for Type II or preformed sponge rubber strips complying with ASTM D1752 for Type I.
- 2.05 Joint Sealant Backing: Provide sealant backings which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved by sealant manufacturer.
- 2.06 Primer: As recommended by joint sealant manufacturer for adhesion of sealant to joint substrates.
- 2.07 Cleaners for Nonporous Surfaces: Non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.
- 2.08 Masking Tape: Non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

- 3.01 Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
- 3.02 Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond, do not allow spillage or migration onto adjoining surfaces.
- 3.03 Installation: Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Provide temporary ventilation during installation of interior joint sealants.
- 3.04 Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- 3.05 Tooling of Non-sag Sealants: Tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- 3.06 Protect joint sealants during and after curing period from contact with contaminating substances or from damage. Cut out and remove damaged or deteriorated joint sealers and reseal joints with matching new materials.

- 3.07 Waste Management: Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperatures. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 07922

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

- 1.01 This Section includes acoustical joint sealants.

PART 2 - PRODUCTS

- 2.01 Acoustical Sealant for Concealed Joints: Non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound; Pecora Corp. "BA-98", Tremco Inc. "Tremco Acoustical Sealant" or approved equal.
- 2.02 Acoustical Sealant for Exposed Joints: Non-oxidizing, skinnable, paintable, gunnable sealant recommended for sealing interior exposed joints to reduce transmission of airborne sound; Pecora Corp. "AC-20 FTR Acoustical and Insulation Sealant", USG "Sheetrock Acoustical Sealant" or approved equal.

PART 3 - EXECUTION

- 3.01 Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated. Install sealants in accordance with manufacturer's instructions.
- 3.02 Protect installed insulation from harmful exposures and from physical damage.
- 3.03 Waste Management: Close and seal tightly all partly used sealant containers and store protected in a well ventilated fire-safe area at moderate temperatures. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 08121

PREFINISHED HOLLOW METAL FRAMES

PART 1 - GENERAL

- 1.01 This Section includes prefinished hollow metal frames with snap-on steel trim.
- 1.02 Fire-Rated Assemblies: Provide fire-rated frames identified with UL label, Warnock Hersey Label, or other label approved by authorities having jurisdiction, indicating applicable fire-ratings. Construct and install assemblies to comply with NFPA Standard No. 80.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Timely Industries, Inc. or approved equal.
- 2.02 Frames: 20-gauge prefinished steel except where heavier gauges are indicated or recommended by manufacturer.
- 2.03 Casings: Timely TA-8 prefinished steel, with corner alignment clips. Manufacturer's standard Alumatone finish.
- 2.04 Fabricate frames from cold-rolled sheet steel conforming to ASTM A366. Roll form or break frames to standard shapes as indicated. Frames shall have 14-gauge hinge-reinforcement plates with extruded tapped holes for minimum 3/16-inch thread penetration depth. Provide for 2-3/4-inch adjustable "T" strikes.
- 2.05 Provide field-applied reinforcement for surface mounted hardware. Coordinate with hardware specified in Section 08710.
- 2.06 Provide WHI or UL fire-rated frames where scheduled.
- 2.07 Framing Finish: Steel shall be chemically cleaned, bonderized, primed and painted in coils. Frames in exterior, high humidity or corrosive areas shall be galvanized prior to finishing. Finish frames with impact-resistant factory-applied polyester baked enamel, color selected by the Architect from manufacturer's standards.

PART 3 - EXECUTION

- 3.01 Install prefinished hollow metal frames in accordance with manufacturer's instructions and reviewed shop drawings.
- 3.02 Install fire-rated frames in accordance with NFPA Standard No. 80.
- 3.03 Adjust door frames as required for proper operation. When complete, frames shall be clean, straight and free from dents, scratches and other damage and defects. Clean frames using materials and methods recommended by manufacturer.

END OF SECTION

SECTION 08121

FLUSH WOOD DOORS

PART 1 - GENERAL

- 1.01 This Section includes flush wood doors.
- 1.02 Shop Drawings: Indicate location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other data.
 - A. Shop drawings shall comply with AWS Section 1 – Submittals.
 - B. Furnish an AWS "Certified Compliance Label" on the first page of the shop drawings.
- 1.03 Flush wood door construction shall comply with Architectural Woodwork Standards (AWS) Section 9 for Premium grade doors.
- 1.04 Fire-Rated Doors: Provide wood doors that comply with California Building Code (CBC) Section 715; are identical in materials and construction to units tested in door and frame assemblies in accordance with NFPA 252 or UL 10C; and are labeled and listed by UL, Warnock Hersey, or other testing and inspection agency acceptable to authorities having jurisdiction. Labels shall comply with NFPA 80 and be permanently affixed to the door.
- 1.05 Allowable Tolerances:
 - A. Warp Tolerance: As specified in Section WDMA T-2. In addition, warp tolerance shall apply to pairs of doors and to doors in relation to the frame or jamb in which hung.
 - B. Squareness: WDMA T-3.
 - C. Gap Tolerance: As specified in Architectural Woodwork Standards Section 9, Section 4.3.8 and Section 6.1.20.
 - D. Flushness of Joinery: As specified in Architectural Woodwork Standards Section 9, Section 6.1.21.
- 1.06 Flush wood doors and steel frames specified in Section 08121 shall comply with positive pressure test requirements of NFPA 252 or UL 10C and shall be labeled accordingly by the door and frame manufacturer in a manner approved by authorities having jurisdiction. Door label shall include hourly rating followed by the letter "S" indicating conformance with air leakage resistance testing, serial number, and the listing agency's certification mark.
- 1.07 Temperature-Rise Rating: At exit enclosures and exitways, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure. In addition to the requirements specified for positive pressure test requirements, the door label shall include temperature rise rating.
- 1.08 WI Certified Compliance Program (CCP):
 - A. Before delivery to the Project site, if the fabricator/supplier is:
 - 1. A WI licensee, issue WI "Certificates of Compliance" certifying that items comply with WI requirements for specified grade.
 - 2. A non-WI licensee, furnish a WI "Certified Compliance Tracking Acknowledgement" with the original submittal, evidencing that they have arranged for and will pay inspections required by the WI to comply with the specified requirements. Certified Compliance labels shall be affixed by the WI Inspector.
 - B. Upon completion of installation, furnish a WI Certified Compliance Certificate for the installation.
 - C. In the event of question as to compliance with the referenced standard of any item of work, the Architect may require independent inspection service of questioned items as specified in "Independent Inspection Service" of WI "Services and Quality Control Options" published by the WI.

- 1.09 Warrant each solid core interior door against defects in materials and workmanship for the life of the original installation, including costs of re-hanging. Defects include, but are not limited to the following:
- A. Cores shall not telegraph through door faces. Stile, rail, and core show-through shall be considered a defect when the face of the door varies from a true plane in excess of 0.010-inch in a 3-inch span.
 - B. Doors shall not have warped (bow, cup, or twist) more than that permitted in Architectural Woodwork Standards (AWS) Section 6.1.21.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Algoma Hardwoods, Inc., American Door Manufacturing, Eggers, Graham, Marshfield Door Systems, VTI, Western Oregon Door or approved equal.
- 2.02 Door Type: Flush veneered, five- or seven-ply construction.
- 2.03 Door Grade:
- A. Fabricate flush wood doors to receive transparent finish in accordance with Architectural Woodwork Standards (AWS) Section 9, Premium Grade.
 - B. Fabricate flush wood doors to receive opaque finish in accordance with Architectural Woodwork Standards (AWS) Section 9, Custom Grade.
- 2.04 Cross Banding: Manufacturer's standard, minimum 1/16-inch thick. Fire-retardant treated where required by testing agency.
- 2.05 Fabricate wood doors in sizes indicated for either job-site fitting or factory fit doors to suit frame-opening sizes indicated, at the Contractor's option. Factory fit doors shall comply with the following uniform clearances and bevels:
- A. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of CBC Section 715 for fire-resistance-rated doors.
- 2.06 Factory Finishing: Doors may be factory-finished at Contractor's option.
- A. Transparent Finish Doors: Prefinish to match Architect approved samples as follows:
 - 1. Architectural Woodwork Standards (AWS) Section 5, Premium Grade.
 - 2. Finish: Manufacturer's standard finish with performance requirements comparable to Architectural Woodwork Standards (AWS) Section 5, System 12 – Polyurethane, Water-Based, complying with VOC requirements.
 - 3. Staining: Match Architect approved sample.
 - 4. Effect: Filled finish.
 - 5. Sheen: Satin, 31- to 45-degrees.
- 2.07 Veneer:
- A. Transparent Finish Doors
 - 1. Veneer Species and Grade: Architectural Woodwork Standards (AWS) Grade AA, plain sliced White Birch.
 - 2. Veneer Matching: Book and balance matching.
 - 3. Pairs and Sets: Provide pair matching and set matching for pairs of doors and for doors hung in adjacent sets.
 - 4. Doors in same room or area shall be matched for color and grain.

5. Doors that are adjacent to or become a component of other architectural woodwork shall conform to the applicable requirements of AWS Section 4 – Sheet Products and Section 06 40 23.
- 2.08 Adhesive: NWWDA IS-1.6, Type II adhesive bond or better for cores, Type I adhesive bond for faces and cross bands.
- 2.09 Cores:
 - A. 20-Minute Fire-Rated Doors and Non-rated Doors: Solid particleboard conforming to ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.
 - B. Fire-Rated Doors Greater than 20-Minute Rated: Incombustible mineral approved by labeling authority. Provide top, bottom, and intermediate blocking for surface-mounted hardware.
- 2.10 Edge Construction:
 - A. 20-Minute Fire-Rated Doors and Non-rated Doors:
 1. Stiles and Rails: Minimum 1-3/8-inch wide by full core thickness glued to core. Exposed edges of stiles shall be smooth, straight cut, free from knots, pitch pockets, and other defects for a minimum distance of 1/4-inch from the outside edge along the entire stile.
 2. Species:
 - a. Stiles: Same species as face for doors to receive transparent finish with no finger joints permitted on lock stiles; close-grain hardwood for doors to receive paint finish.
 - b. Rails: Hardwood or softwood at manufacturer's option.
 3. Edge Banding: Minimum 1/2-inch wide by full core thickness. Species for doors to receive transparent finish shall be same as face with no finger joints permitted on lock stile. Species for doors to receive paint finish shall be close-grain hardwood.
 - B. Fire-Rated Doors Greater than 20-Minute Rated:
 1. Top Rail: Door manufacturer's standard special laminated material.
 2. Stiles and Rails: Hardwood, fire-retardant treated where required by label. Where not required to be fire-retardant treated, provide same species for stiles as face veneer for doors to receive transparent finish. Sizes required by testing agency.
- 2.11 Edge Clearances:
 - A. Jambs and Heads: 1/8-inch.
 - B. Meeting Stiles of Pairs of Doors: 1/4-inch.
 - C. Bottom of Door to Top of Finish Floor: 3/4-inch at concrete, 5/8-inch at resilient flooring, 3/8-inch at carpet, tile, thresholds, and other finish flooring.
- 2.12 Door Louvers: Prefabricated 12-inch x 12-inch 20-gauge steel units. Manufacturer's standard baked-enamel finish.
- 2.13 Vision Light Frames: Anemostat "LoPro" or approved equal.

PART 3 - EXECUTION

- 3.01 Condition doors to average prevailing humidity in installation area prior to hanging.
- 3.02 Install wood doors in accordance with the manufacturer's printed instructions, as indicated and in accordance with Architectural Woodwork Standards, Section 9.

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- 3.03 Fire-Rated Doors: Install in fire-rated frames in accordance with requirements of NFPA Standard No. 80.
- 3.04 When complete, doors shall be flat within allowable tolerance, shall be plumb in all positions of swing, and shall operate smoothly, quietly, and free from binding. Re-hang or replace doors that do not swing or operate freely.
- 3.05 Exposed surfaces shall be uniform in appearance, clean and free from scratches, tool marks, dents, discoloration, stains, and other damage and defects.

END OF SECTION

SECTION 08310

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

- 1.01 This Section includes access doors at all required locations.
- 1.02 Fire-Rated Door Assemblies: Units shall comply with NFPA 80, be identical to door and frame assemblies tested for fire-test-response characteristics, and are labeled and listed by UL, Warnock Hersey, or other testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.
- 2.02 Non-Fire-Rated Access Doors with Exposed Trim:
 - A. Door Design: Flush panel.
 - B. Material: Commercial grade cold-rolled steel with 16-gauge frame and 14-gauge door; phosphate dipped with baked-on rust-inhibitive gray primer for field painting as specified in Section 09900.
 - C. Exposed Trim: 1-inch flange overlapping surfaces surrounding door frame.
 - D. Hinge: Concealed pin hinge mechanism and continuous piano hinge.
 - E. Latch/Lock: Flush screwdriver operated stainless steel cam latch.
- 2.03 Non-Fire-Rated Access Doors with Exposed Trim in Toilet Rooms, Custodial Rooms, and other Wet Areas:
 - A. Door Design: Flush panel.
 - B. Material: Stainless steel, 16-gauge frame and 14-gauge door; satin polish finish.
 - C. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.
 - D. Hinge: Concealed pin hinge mechanism and continuous piano hinge.
 - E. Latch/Lock: Flush screwdriver operated stainless steel cam latch. Provide keyed locks at access doors located in public areas.
 - F. Provide insulated doors in insulated or acoustically rated construction.
- 2.04 UL Fire-Rated Access Doors with Exposed Trim:
 - A. Door Design: Flush panel.
 - B. Material: Commercial grade cold-rolled steel with 16-gauge frame and 20-gauge door; phosphate dipped with baked-on rust inhibiting primer for field painting as specified in Section 09900.
 - C. Insulation: 2-inch thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.
 - D. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.
 - E. Hinge: Concealed pin hinge.
 - F. Continuous Closer: Automatic spring closer to automatically close and latch door.

- G. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush key lock. Panels shall have interior latch release mechanism allowing the door to be unlocked from the inside.
- 2.05 UL Fire-Rated Access Doors with Exposed Trim at Toilet Rooms, Custodial Rooms, and Other Wet Areas:
- A. Door Design: Flush panel.
 - B. Material: Stainless steel, 16-gauge frame and 20-gauge door; satin polish finish.
 - C. Insulation: 2-inch thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.
 - D. Exposed Trim: Flange integral with frame, ¾-inch wide, overlapping surrounding finished surface.
 - E. Hinge: Concealed pin hinge.
 - F. Continuous Closer: Automatic spring closer to automatically close and latch door.
 - G. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush key lock. Panels shall have interior latch release mechanism allowing the door to be unlocked from the inside.

PART 3 - EXECUTION

- 3.01 Install access doors in accordance with manufacturer's instructions.
- 3.02 Frames, doors and trim pieces shall not vary from straightness or snug contact fit by more than 1/16-inch.
- 3.03 Adjust hardware and panels after installation for proper operation.

END OF SECTION

SECTION 08412

INTERIOR ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

- 1.01 This Section includes interior aluminum-framed storefronts, including interior clerestory window framing.
- 1.02 Shop Drawings: Include for fabrication and installation, including large scale elevations, plans, full scale detail sections of typical members, anchors, reinforcement, and glazing. Include details at head, jambs, sill and mullions for each opening.
- 1.03 Warrant interior aluminum-framed storefronts that fail in materials or workmanship within 10-years from date of Substantial Completion. Failures include, but are not limited to structural failures including excessive deflection, and deterioration of metals, metal finishes, and other materials beyond normal weathering. Furnish warranty covering aluminum finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading, as defined, for 20-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Kawneer Company, Vistawall Architectural Products, United States Aluminum or approved equal.
- 2.02 Aluminum Members: 6063-T5 alloy and temper.
- 2.03 Fasteners: Aluminum or Series 300 nonmagnetic stainless steel.
- 2.04 Concealed Flashing: Dead-soft stainless steel or extruded aluminum as selected by manufacturer for compatibility with other components.
- 2.05 Brackets and Reinforcements: Aluminum or nonmagnetic stainless steel. Provide non-staining, non-ferrous shims for installation and alignment as required.
- 2.06 Interior Storefront Framing Systems: Fabricate from extruded aluminum members of size and profile to match existing exterior storefront framing. Include sub-frames and other reinforcing members as required.
- 2.07 Miscellaneous Brake Shapes: Provide headers, closures, anchors and supports as indicated and required. Fabricate from minimum 0.090-inch aluminum.
- 2.08 Fabricate interior aluminum-framed storefronts to designs, sizes and thicknesses to match existing exterior storefront framing. Provide miscellaneous aluminum brake metal closures and flashings as indicated, finished to match interior aluminum-framed storefronts.
- 2.09 Exposed surfaces shall be finished too match existing exterior aluminum-framed storefronts.

PART 3 - EXECUTION

- 3.01 Set units plumb, level, and true to line, without warp or rack of framing members. Install components in proper alignment and relation to established lines. Provide proper support and anchor securely in place
- 3.02 Installation Tolerances:
 - A. Variation from Plane: Do not exceed 1/8-inch in 12-feet of length or 1/4-inch in any total length.
 - B. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end-to-end in line shall not exceed 1/16-inch.
 - C. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8-inch.

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- D. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32-inch.

END OF SECTION

SECTION 08560

FIRE-RATED WINDOWS

PART 1 - GENERAL

- 1.01 This Section includes the following:
- A. Sliding fire-rated pass windows.
 - B. Fixed fire-rated windows.
- 1.02 Shop Drawings: Furnish shop drawings for each type of fire-rated window. Include layout and installation details, including anchors, section details of typical composite members, including reinforcement and adjacent materials, hardware, glazing details and accessories.
- 1.03 Fire-rated Assemblies: Furnish fire-rated pass windows which comply with NFPA No. 80 and have been tested, rated and labeled in accordance with UL 9. Furnish each door with a metal UL label indicating rating in hours of exposure to fire and letter designation of location for which assembly is approved.
- 1.04 Warrant fire-rated windows to be free from defective materials and workmanship for a period of 2-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Sliding Fire-rated Pass Windows:
- A. Approved Manufacturer: D.V. Fyre-Tec, Inc. "Series 900" or approved equal horizontal sliding window with automatic closing.
 - B. Fire-rated windows shall conform to UL 9 and shall be labeled with a fire-rest rating of 60-minutes. Units shall be designed and fabricated to meet glass sizes, window sizes, and opening dimensions established by NFPA 80. Hardware shall conform to NFPA 80 requirements. Operable fire-rated windows shall be self-closing and latching by means of a heat activated fusible link operator.
 - C. Material: Fabricate windows from roll-formed galvanized lock-forming quality steel per ASTM A653.
 - D. Frame and insert corners shall be mitered and welded.
 - E. Operable sash shall be supported on two field adjustable roller trucks consisting of corrosion resisting steel with integral ball bearing rollers. Rollers shall be supported and operate on a stainless steel track.
 - F. Fasteners: Non-magnetic stainless steel, cadmium-plated steel, or zinc-plated steel.
 - G. Glazing: Premium clear ceramic glass, 1-hour rated. Windows shall be factory glazed with UL labeled glass meeting or exceeding the hourly rating required for the frame label. Individual lites shall display a UL-label permanently affixed and in accordance with CBC and NFPA 80.
 - H. Hardware: Equip sliding panels with stainless steel, spring-loaded latch bolts mounted on the interlocking member. Equip with automatic closers which close and lock windows upon melting of a 130-deg. F. fusible link.
 - I. Finish: Windows and associated parts shall be cleaned, pre-treated with iron phosphate and factory powder coated and cured with manufacturer's standard color of not less than 2.0-mil; color as selected by the Architect.

2.02 Fixed Fire-rated Windows:

- A. Approved Manufacturer: D.V. Fyre-Tec, Inc. "Series 950" Fixed Lite Windows or approved equal.
- B. Fixed steel windows shall be designed for inside field glazing.
- C. Fire-rated windows shall conform to UL 9 and shall be labeled with a 1-hour fire-test rating. Units shall be designed and fabricated to meet glass sizes, window sizes, and opening dimensions established by NFPA 80.
- D. Material: Fabricate windows from roll-formed galvanized lock-forming quality steel per ASTM A653.
- E. Frame and insert corners shall be mitered and welded.
- F. Fasteners: Non-magnetic stainless steel, cadmium-plated steel, or zinc-plated steel.
- G. Glazing: Premium clear ceramic glass, 1-hour rated. Windows shall be factory glazed with UL labeled glass meeting or exceeding the hourly rating required for the frame label. Individual lites shall display a UL-label permanently affixed and in accordance with CBC and NFPA 80.
- I. Finish: Windows and associated parts shall be cleaned, pre-treated with iron phosphate and factory powder coated and cured with manufacturer's standard color of not less than 2.0-mil; color as selected by the Architect.

PART 3 - EXECUTION

- 3.01 Install fire-rated windows in compliance with manufacturer's specifications and recommendations for installation of windows, hardware, operators, and other components.
- 3.02 Set units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
- 3.03 Install fire-rated windows in compliance with NFPA 80 and NFPA 101.
- 3.04 Adjust operating sash and hardware to provide for smooth operation.

END OF SECTION

SECTION 08720

FINISH HARDWARE

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

- A. The requirements of the "General Conditions of the Contract" and of Division 1, "General Requirements", apply to the Work of the Section with the force and effect as though repeated in full herein.

1.02 SUMMARY

- A. Required: Provide labor, materials, tools, plant equipment, transportation in performing operations necessary for, reasonably incidental to, the proper execution for completion of providing finish hardware, whether specifically mentioned or not; when required, indicated, specified herein, or implied thereby to carry out the apparent intent. Some of the items specified herein are:
 - 1. Study Work, related Drawings and specifications of other crafts whose Work abuts, adjoins, or is affected by Work of the Section. Consult other trades, expedite, and coordinate materials and labor to avoid omissions and delays.
 - 2. "Hardware Groups" have been assigned to the various doors required for this Work, as described in the Door Schedule on the Drawings; the hardware groups are described in detail in this Section of these Specifications.
 - 3. Provide Finish Hardware indicated on Drawings or specified, necessary to complete the Work in accordance with Drawings and specifications. When taking off quantities, check Drawings, details, and specifications carefully to see that the necessary items are included. Comply with the intent of the Americans with Disabilities Act [ADA], Title III, enacted on July 26, 1990; and the State of California, Title 24.
 - 4. Base bids on materials specified. Should a Contractor choose to provide alternate hardware, the Contractor is to furnish a base bid for hardware specified and alternate adds and deducts for those items to be substituted. Physical mounted Samples and manufacturers literature on the alternate bid products must be delivered to the Architect for final analysis. The Architect reserves the right to charge the Owner the current hourly fee necessary to review and investigate the alternate product submitted after the due date or alternate products submitted on the schedule of hardware.
 - 5. Templates and Instructions.
 - 6. Guarantee.
- B. Related Work Specified in other Sections.
 - 1. Ceiling access hardware.
 - 2. Demountable partition system.
 - 3. Toilet accessories.

1.03 SUBMITTALS

A. Materials List:

1. Within 35 days after the award of the Contract, and before finish hardware is ordered for this Work, submit to the Architect for his review, a complete list of the finish hardware proposed to be provided for this Work, giving the manufacturer's name and catalog number for each item. Furnish six [6] copies of finish hardware schedule for review, and two [2] brochures of the items proposed to be provided for this Project.
2. Make submittals, or resubmittals in accordance with the Contract Documents. Returned resubmittals to the Architect within two weeks after receipt of the unaccepted submittal.

B. Templating:

1. Prior to installation, deliver to the installing personnel complete recommendations from the manufacturer regarding installation methods. Provided templates for every Door/Frame fabricators.
2. Furnish hardware templates to other Subcontractors where special mortising, tapping, reinforcing, or similar preparatory Work during fabrication is required to receive hardware. Furnish templates within two weeks after the Architect reviews the hardware schedule.
3. Deliver hardware required, to be installed during fabrication of labeled doors, when requested, prepaid to the door fabricator.

1.04 QUALITY ASSURANCE

- A. Qualifications of Supplier: Employ an Architectural Hardware Consultant (AHC), who be made available to the Architect for consultation, at no additional cost, during the course of construction. A minimum of two hours a week of AHC time, after shipment of the hardware to the job site, spent investigating and inspecting the installation and answering questions regarding the installation of the hardware.
- B. Review: Check the installation of finish hardware at the completion of the Project, making minor adjustments required, supervising hardware replacements, and report to the Architect on the completeness of the installation.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental Concern for Packaging: Pack hardware shipped to the jobsite in biodegradable materials as paper or cardboard boxes. If non-biodegradable packing is utilized; as plastic, plastic bags, Styrofoam; the Contractor will be responsible to dispose of the non-biodegradable packing to a license or authorized collector for recycling of the non-biodegradable packing.

1.06 WARRANTY

- A. Furnish a written guarantee of hardware under this Section against defective materials and workmanship for a period of Three (3) years for the lockset and exit devices; ten [10] years for door closers and two [2] year for the remainder of the hardware.

PART 2 – PRODUCTS

2.01 FASTENERS

A. General:

1. Furnish with finish hardware the necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in a position for a long life under hard use.
2. Provide fastenings where necessary with expansion shields, toggle bolts, sex bolts, and other anchors designated by the Architect, according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. Thru-bolted closers and exit devices on labeled wood doors if required by the door manufacture. Fasten thresholds with machine screws, anchors and caulk around the perimeter with a clear silicon sealant. Provide fasteners of exterior hardware in brass, bronze or stainless steel.
3. Harmonize fastenings with the hardware as to material and finish.

2.02 HINGES AND PIVOTS

A. Unless otherwise specified, provide Three-knuckle, bearing, button tip, and full mortise template type butts with non-rising loose pins.

1. Exterior door hinges: Provide out-swinging door hinges of stainless steel with non-removable pins and security studs.
2. Interior door hinges: Wrought steel, polished and plated to match specified finish. Provide three hinges up to 90 inches high and one additional hinge for every 30 inches or fraction thereof.
3. Where required to clear trim or permit doors to swing 180 degrees, provide hinges of sufficient throw.
4. Provide heavy weight butts, size 5"x 4-1/2", or more, for doors over 42" inches in width; and more than 1 3/4" thick.
5. At labeled doors, provide steel or stainless steel hinges. Labeled doors over eight feet in height provide heavy weight hinges.
6. Finishes: Interior 652.
7. Products: Ives, Stanley or Hager for hinges; Ives or Rixson for Pivots

2.03 LOCKS AND LOCK TRIM

- A. Provide trim for the locksets and latchsets by one manufacturer as listed.
- B. Provide steel wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8" beyond frame trim or the inactive leaf of a pair of doors. Provide cast cylinder collars.
- C. Provide functions listed in the individual hardware groups.
- D. Finish: 626

- E. Provide locksets, latchsets and trim of the following manufacturers:

Manufacturer	Schiage	Von Duprin
Series	D SERIES	99/33 Series
Trim	SPARTA	Pull/ Lever

2.04 KEYING

- A. Provided patented Schiage Everest D interchangeable removable core cylinders construction keyed.
- B. Supply each cylinder with three keys. Supply six grand master keys, four master keys for each master set. Supply up to twelve construction masters. Manufacture keys from nickel silver alloy.
- C. Deliver, upon completion of the building, permanent change keys, master keys, and grand master keys to the building Owner or his authorized representative. Properly tag cylinders and keys to indicate their intended location and to enable the Owner, with a minimum of effort to establish his key control system.
- D. The Contractor is responsibility to make keyed construction core cylinders and construction keys inoperative upon completion of the building.
- E. Finish: 630/626

2.05 DOOR CLOSERS

- A. Door closers to be heavy duty, full cover, hydraulic type, with high strength cast iron case, full rack and pinion construction of heavy heat-treated steel.
- B. Size surface closers in accordance with the manufacturer's recommendations at the building site.
- C. Surface closers to have adjustable spring power, with each closer body having adjustable closing forces. Supply closer with separate, tamper resistant, non-critical regulating screw valves for closing speed, latching speed, and backcheck control as a standard feature.
- D. Mount the closer body and arms on the non-public side of the opening; on the interior side of exterior openings.
- E. Finish: 689
- F. Door closers to be of the following manufacturer:

	LCN	Norton
Heavy Duty Non-Sized	1461	7500

2.06 DOOR STOPS AND HOLDERS

- A. Door stops to be provided for each door leaf. Provide for every door a floor, wall, or an overhead stop.

- B. Place door stops in a position that they permit maximum door swing, but do not present a hazard or obstruction. Provide floor strikes on floor holders of proper height to engage holders or doors.
- C. Overhead stops and holders are heavy duty, solid brass with specified, no plastic type of parts. Use overhead stops and holders where ever floor or wall stops are not used and where the total width of the door cannot swing to a wall because of design or other obstruction by other equipment and materials.
- D. Finish: 630
- E. Products: Ives.

2.07 DOOR SILENCERS

- A. Provide door silencers at openings without weatherstripping or sound seals. Provide four at each pair of doors and three for each single door. Stick on silencers are not allowed. Provide Hager silencers 308D for metal frames; 307D for wood frames. Products that are equal by Ives are acceptable.

2.08 OWNERS STOCK

- A. At the completion of the Project, supply to the Owner the following items:
 - 1. One complete biting list of key cuts.
 - 2. One set of instruction and installation instructions sheets for each item provided. One set of parts list for each item provided. One each of non-standard tool for installation of each item provided.

PART 3 – EXECUTION

3.01 PRODUCT HANDLING

- A. Packaging:
 - 1. Furnish finish hardware with each unit clearly marked or numbered in accordance with the hardware schedule.
 - 2. Pack each item complete with necessary pieces and fasteners.
 - 3. Properly wrap and cushion each item to prevent scratches during delivery and storage.
- B. Deliveries:
 - 1. Stockpile items sufficiently in advance to ensure their availability and make necessary deliveries in a timely manner to assure orderly progress of the total Work. Mark each item of hardware for a specific door, item number, packaging the material to insure no damage in shipment to the job site. Drop shipments from the manufacturer to the job site are not allowed.

3.02 INSTALLATION OF FINISH HARDWARE

- A. Install Hardware by experienced installers. Install strictly according to the hardware manufacturer's installation instructions. Install hardware with manufacturer's supplied fasteners.

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- B. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware to protect against loss and damage.
- C. Fit hardware before the final coat of paint or other finish is applied, then removed for the final coat. Provide neat cutting and mortises. Conceal evidence of cutting in the finished Work. Permanently install the hardware after finishing operations are complete and dry. Protect knobs/levers from scratching or other damage. Adjust hardware, and turn over to the Owner, in optimum operating condition. Tag keys and turn over to the Owner at the time of acceptance of the Project.
- D. Upon completion of the installation, the Contractor is to deliver to the Architect, a report stating that an inspection was made. The report will list adjustments completed, and that finish hardware provided under this Section has been installed in optimum working condition.
- E. The following are the list of manufactures' listed in the hardware sets:

HARDWARE	MANUFACTURER
Hinges	H.B. Ives
Cylinders	Schlage
Locksets/Deadbolts	Schlage
Closers	LCN
Push, Pulls, Kickplates	Ives and Elms
Stops	Ives
Panic Hardware	Von Duprin

- F. The following are the hardware sets referred to in the plans door schedule.

HW SET: 01

Each Assembly to have:

NON-RATED

2	EA	HINGE	3CB1 4.5 X 4	652	IVE
1	EA	ELECTRIC HINGE	3CB1 4.5 X 4.5 TW4	652	IVE
1	EA	CORE ONLY	23-030	626	SCH
1	EA	EU STOREROOM LOCK	ND80TDEU SPARTA	626	SCH
1	EA	SURFACE CLOSER	1461 RW / PA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS406 - CCX	630	IVE
CARD READER, POWER SUPPLY AND WIRING AS REQUIRED FOR A COMPLETE INSTALLATION					

HW SET: 02 – NOT USED

HW SET: 03

Each Assembly to have:

NON-RATED

3	EA	HINGE	3PB1 4.5 X 4	652	IVE
1	EA	PASSAGE SET	ND10S SPARTA	626	SCH
1	EA	WALL STOP	WS406-CCX	630	IVE

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HW SET 04

Each Assembly to have:

NON-RATED

3	EA	HINGE	3CB1 4.5 X 4	652	IVE
1	EA	CLASSROOM LOCK	ND70TD SPARTA	626	SCH
1	EA	CORE ONLY	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS406-CCX	630	IVE

HW SET: 05

Each Assembly to have:

NON-RATED

3	EA	HINGE	3CB1 4.5 X 4	652	IVE
1	EA	PANIC HARDWARE	99L 996L 17-LEVER 3'	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	CORE ONLY	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS406-CCX	630	IVE

HW SET: 06

Each Assembly to have:

NON-RATED

6	EA	HINGE	3CB1 4.5 X 4	652	IVE
1	EA	AUTO FLUSH BOLTS	942	626	DCI
1	EA	DUSTPROOF STRIKE	80	626	DCI
1	EA	CLASSROOM LOCK	ND70TD SPARTA	626	SCH
1	EA	CORE ONLY	23 -030	626	SCH
1	EA	COORDINATOR	672	600	DCI
1	EA	T-ASTRAGAL	355CS 84"	628	PEM
2	EA	SURFACE CLOSER	1461 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 34"	630	IVE

HW SET: 07

Each Assembly to have:

NON-RATED

6	EA	HINGE	3CB1 4.5 X 4	652	IVE
2	EA	SURF VERT ROD EO LBR	9927EO-LBR	626	VON
2	EA	SURF VERT ROD LBR	9927L 996L-17 LEVER-LBR	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	CORE ONLY	23-030	626	SCH
4	EA	SURFACE CLOSER	1461 DEL CUSH	689	LCN
4	EA	KICK PLATE	8400 10" X 35"	630	IVE

HW SET: 08

Each Assembly to have:

NON-RATED

3	EA	HINGE	3CB1 4.5 X 4	652	IVE
1	EA	PRIVACY SET	ND40S SPARTA	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA FC	689	LCN
1	EA	WALL STOP	WS406 -CCX	630	IVE

HW SET: 09
Each Assembly to have:
NON-RATED
1 EA

TRACK AND HARDWARE BY DOOR SUPPLIER

END OF SECTION

SECTION 08800

GLAZING

PART 1 - GENERAL

- 1.01 This Section includes interior and exterior glass and glazing.
- 1.02 Provide heat strengthened glass lites where recommended by glass manufacturer as determined by glass stress analysis calculations based on glass unit sizes indicated and shading patterns occurring on the glass.
- 1.03 Warranty:
 - A. Insulating Glass: Furnish written warranty signed by glass manufacturer, agreeing to furnish replacements for those insulating glass units developing manufacturing defects as defined, within 10-years from date of Substantial Completion.
 - B. Mirror Glass: Furnish written warranty agreeing to furnish replacement mirrors for those units developing silver spoilage within 15-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Tinted Insulating Glass with Low E Coating: Outside lite of 1/4-inch thick heat-strengthened EverGreen tinted float glass VE-52 with Low E coating on No. 2 surface; inside lite of 1/4-inch thick clear annealed float glass; separated by a 1/2-inch thick hermetically sealed air space with mill finish aluminum spacer; nominal 1-inch unit thickness. Provide heat strengthened lites where recommended by glass manufacturer based on glass lite sizes and shading patterns. Provide fully tempered lites where indicated or required by code.
- 2.02 Mirror Glass: ASTM C1036, Type I, Class 1, Quality q1 for units under 25-square feet, Quality q2 for units over 25-square feet, silver coated and electrolytically copper plated, with edges protected with clear vinyl tape or other protective coating applied before installation. Provide stainless steel channel or angle frames with maximum 1/2-inch exposed legs, with No. 4 finish. Mirrors shall be in single piece units for each location.
- 2.03 Silicone Glazing Sealant: One-part elastomeric silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A and O as applicable; Dow Corning 999, General Electric "SCS 1200", Rhone-Poulenc, Inc. "Rhodorsil 3B", Tremco "Proglaze" or approved equal.
- 2.04 Back-Bedding Mastic Glazing Tape: AAMA 800, preformed, butyl-based elastomeric tape, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers.
- 2.05 Expanded Cellular Glazing Tape: AAMA 800, closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces.
- 2.06 Dense Elastomeric Compression Seal Gaskets: Molded or extruded neoprene, EPDM, or silicone gaskets of profile and hardness required to maintain watertight seal; complying with ASTM C864.
- 2.07 Soft Compression Gaskets: Extruded or molded closed cell, integral-skinned neoprene, EPDM, or silicone of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II, black.
- 2.08 Setting Blocks: Neoprene, EPDM or silicone blocks as required, 80 to 90 Shore A durometer hardness.
- 2.09 Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.
- 2.10 Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement.
- 2.11 Mirror Mastic: Palmer "Mirro-Mastic" or approved equal for securing glass mirrors.

PART 3 - EXECUTION

- 3.01 Comply with printed recommendations of glass, sealants, gaskets, and other glazing materials manufacturers.
- 3.02 Protect glass from edge damage during handling and installation.
- 3.03 Install setting blocks of proper size in sill rabbet, located to comply with referenced glazing standard. Set blocks in thin course of sealant.
- 3.04 Provide edge blocking to comply with requirements of referenced glazing standard except where otherwise required by glass unit manufacturer.
- 3.05 Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- 3.06 Protect glass from breakage. Protect glass from contact with contaminating substances. Remove immediately by methods recommended by glass manufacturer.
- 3.07 Wash glass on both faces not more than 4-days prior to date scheduled for inspection for Substantial Completion.

END OF SECTION

SECTION 09110

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

- 1.01 This Section includes light-gauge non-load bearing wall framing systems, including metal studs, wall furring, framing for ceilings, and backing plates.
- 1.02 Design and Performance Requirements:
- A. Where stud gauge and spacing is not indicated, engineer non-structural metal framing to comply with the following requirements.
 - B. Stud Systems: Select steel studs in accordance with manufacturer's standard load tables and the following deflection criteria, based on stud depth of 3-5/8-inch and spacing indicated and partition height required:
 - 1. Partitions to Receive Gypsum Board: L/240.
 - 2. Partitions to Receive Tile Backer Board: L/360.
 - 3. Framed Ceilings: L/360.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Angeles Metal Products, Clark Steel Framing Systems, Inc., Consolidated Systems, Inc., Dale/Incor Industries, Delta Metal Products, Dietrich Industries, Inc., Knorr Steel Framing Systems, The Steel Network Inc., Unimast, Inc., Western Metal or approved equal.
- 2.02 Metal Studs:
- A. Material: Mill-certified galvanized steel conforming to ASTM A653, G40 coating, minimum yield strength 33,000-psi.
 - B. Construction: Formed C-channel section conforming to ASTM C645.
 - C. Stud Thickness: As indicated or as required for specified deflection criteria, based on stud depth and spacing indicated and partition height required. If stud spacing is not indicated, space studs at 16-inches on center.
- 2.03 Runner Tracks:
- A. Material: Mill-certified galvanized steel conforming to ASTM A653, G40 coating, minimum yield strength 33,000-psi.
 - B. Construction: Formed channel section conforming to ASTM C645.
 - C. Size: Minimum 1-inch flange width; web depth matching studs.
 - D. Thickness: Same as studs.
- 2.04 Vertical Deflection Connection: The Steel Network Inc. "VertiClip" or "VertiTrack", FireTrak Corp "Shadowline", Metal-Lite "Slotted Slip Track" or approved equal meeting head of wall connection criteria as required by CBC and as indicated in UL2079 for cyclic wall movement.
- 2.05 Metal Channels: Mill-certified galvanized steel conforming to ASTM C653, G40 coating, minimum yield strength 33,000-psi.
- A. Framing, Furring, and Stiffening:

<u>Size, Inches</u>	<u>Pounds per 1,000 Lineal Feet</u>
3/4 cold rolled	300
1-1/2 cold rolled	475
2 cold rolled	590

- B. Furring Channels: Minimum 20-gauge galvanized steel with knurled faces; hat-shaped or Z-section as required.
- 2.06 Tie Wire: No. 16-gauge, galvanized, single-strand annealed steel or No. 18-gauge, galvanized, double-strand annealed steel.
- 2.07 Screws: ASTM C1002, Type S, pan head sheet metal screws, minimum 1/2-inch length.
- 2.08 Runner Track Fasteners: Tempered-steel pins with corrosive resistant plating or coating, 9/64-inch diameter, minimum 1-1/8-inch penetration.
- 2.09 Compression or Isolation Strips: Fiberglass, 1/2-inch nominal thickness, width equal to width of tracks or studs where used; density such that material will compress to one-half or less of loose thickness.

PART 3 - EXECUTION

- 3.01 Install non-load-bearing steel framing members in accordance with ASTM C754, and as specified.
- 3.02 When studs extend to the underside of structural slabs, secure at top with a slip connection to accommodate slab deflection.
- 3.03 Runner Tracks: Align at floor and ceiling with partition layouts. Secure to structure with fasteners located 2-inches from each end and spaced not to exceed 24-inches on center.
- 3.04 Installation of Metal Studs:
 - A. Install studs spaced 16-inches on center unless otherwise indicated. Screw-fasten framing connections using a minimum of 2 screws for each connection.
 - B. At partition corners and intersections, provide a minimum of 3 studs.
 - C. Unless otherwise indicated, frame openings with double 16-gauge vertical studs securely attached to each jamb of door frame.
 - D. Install continuous horizontal stiffeners in partitions where recommended by stud manufacturer for partition height, stud gauge, stud spacing, number of layers of gypsum board used, and anticipated stud deflection.
 - E. Stiffen openings with horizontal channels. Provide one channel continuous across head of openings extending to third stud beyond on each side. Provide one channel at each frame anchor extending to third stud beyond. Wire-tie or weld horizontal channels to each stud.
- 3.05 Wall Furring, Direct Attachment:
 - A. Attach hat-shaped metal furring channels either vertically or horizontally. For furring positioned horizontally, attach a furring member not more than 4-inches from both the floor and ceiling. Secure with fasteners placed on alternate channel flanges, spaced on 16-inch centers.
 - B. Attach Z-shaped metal channels vertically, spaced 16-inches on center unless otherwise indicated, with fasteners spaced 24-inches on center.
- 3.06 Backing Plates: Install as required for support of wall-hung cabinets, toilet partitions and accessories, and other items to be mounted on vertical surfaces.
- 3.07 Horizontal Framed Surfaces:
 - A. Joist frame with studs of size, gauge and spacing as determined from manufacturer's standard tables based on specified deflection criteria.
 - B. Provide runner channels to receive studs at ceiling and walls of same gauge as studs. Secure with mechanical fasteners at 24-inches on center maximum.
 - C. Secure studs to channels with screws.

- 3.08 Sound Control Work: Specified requirements apply to framing for interior partitions indicated as sound partitions.
- A. Isolate top and bottom runners from direct contact with structure by installing over either continuous compression or isolation strips as specified, or two continuous 1/4-inch beads of acoustical sealant specified in Section 07922 applied at quarter points of track width.
 - B. Studs at terminal ends of partitions abutting intersecting walls or partitions, and studs that would otherwise contact intermediate structural columns shall be similarly installed over strips or sealant.
- 3.09 INSTALLATION TOLERANCES
- A. Variation from Plumb: Maximum 1/8-inch in 10-feet, non-cumulative.
 - B. Variation from Level: Maximum 1/8-inch in 10-feet, non-cumulative.
 - C. Variation from True Plane: Maximum 1/8-inch in 10-feet, non-cumulative.
 - D. Variation from True Position: Maximum 1/4-inch, non-cumulative.
 - E. Variation of Member from Plane: Maximum 1/8-inch, non-cumulative.
- 3.10 Waste Management: Separate and recycle waste materials to the maximum extent possible.

END OF SECTION

SECTION 09120

METAL SUSPENSION SYSTEMS

PART 1 - GENERAL

- 1.01 This Section includes metal ceiling suspension systems for gypsum wallboard ceilings.
- 1.02 Metal ceiling suspension system shall limit deflection of finished ceilings to less than L/360.

PART 2 - PRODUCTS

- 2.01 Metal Channels: ASTM C645, galvanized in accordance with ASTM A653, G60 coating designation.

A. Framing, Furring, and Stiffening:

<u>Size, Inches</u>	<u>Pounds per 1,000 Lineal Feet</u>
3/4 cold rolled	300
1-1/2 cold rolled	475
2 cold rolled	590

B. Furring Channels: Minimum 20-gauge galvanized steel with knurled faces; hat-shaped or Z-section as required.

- 2.02 Hanger Wire: Galvanized, soft, mild annealed steel; 8-gauge, unless otherwise indicated.
- 2.03 Diagonal Bracing Wire: Galvanized, soft, mild annealed steel; 12-gauge, unless otherwise indicated.
- 2.04 Tie Wire: No. 16-gauge, galvanized, single-strand annealed steel or No. 18-gauge, galvanized, double-strand annealed steel.
- 2.05 Screws: ASTM C1002, corrosion resistant, for attachment to metal framing 25-gauge and lighter; ASTM C954 for attachment to metal framing 20-gauge and heavier. Thread and head designs and lengths as recommended by manufacturer for uses and materials involved.
- 2.06 Hanger and Bracing Wire Fasteners:
- 2.07 Hanger Wires: Connection device capable of carrying not less than 100-pounds.
- 2.08 Bracing Wires: Connection device capable of carrying not less than 200-pounds or the actual design load, whichever is greater, with a safety factor of 2 without yielding.
- 2.09 Furring Channel Clips: Fabricated from galvanized wire, for attaching furring channels to cold-rolled channels.
- 2.10 Compression Stiffeners: 20-gauge channel studs, 1-1/2-inches.

PART 3 - EXECUTION

- 3.01 Space 8-gauge hanger wires 48-inches on center along carrying channels and within 6-inches of ends of carrying channels.
- 3.02 Install 1-1/2-inch cold rolled carrying channels 48-inches on center and within 6-inches of walls. At splices, interlock flanges, overlap ends 12-inches, and wire-tie with double loops of No. 16-gauge wire.
- 3.03 Install 3/4-inch cold rolled channels at right angles to carrying channels, spaced 24-inches on center and within 6-inches of walls. Provide one-inch clearance between furring channels and abutting walls and partitions. Attach to carrying channels by saddle-tying around carrying channels with one strand of No. 16 or two strands of No. 18-gauge tie wire. At splices, nest furring channels with a minimum 8-inch overlap and wire-tie each end with double loops of No. 16-gauge wire.
- 3.04 Install 4-way 45-degree diagonal bracing wires at 12'-0" x 12'-0" within 6-inches of walls. Diagonal bracing wires shall be located at the intersection of main runner and cross-furring member. Provide connection between diagonal wires and main runner so as to prevent slipping for a 200-pound approximate seismic load.

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- 3.05 Install hanger and bracing wire anchors so the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
- 3.06 Fasten hanger wires with not less than 3 tight turns; fasten bracing wires with not less than 4 tight turns. Make all tight turns within a distance of 1-1/2-inches.
- 3.07 Install uplift stiffener for each 144-square feet of ceiling, consisting of a vertical metal stud occurring at the junction of the carrier and furring channel. Wire tie to carrier or screw to channel and secure to overhead structure.
- 3.08 Waste Management: Separate and recycle waste materials to the maximum extent possible.

END OF SECTION

SECTION 09130

ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

PART 1 - GENERAL

- 1.01 This Section includes acoustical suspension systems for acoustical panels.
- 1.02 Suspension systems shall be designed, fabricated, and installed to meet requirements of ASTM C635.

PART 2 - PRODUCTS

- 2.01 Exposed Narrow Face Grid System:
 - A. Approved Manufacturers: Armstrong "Suprafine XL HRC" or approved equal.
 - B. Material: Hot dipped galvanized steel made from USA produced recycled steel.
 - C. Main Runners: 9/16-inch flange, 1-11/16-inch high, double web construction.
 - D. Cross Runners: 9/16-inch flange, double web construction.
 - E. Wall Angle, Reveals, and Miscellaneous Trim: Roll-formed from electrogalvanized steel strip to profiles indicated.
 - F. Finish: Factory-applied white low gloss enamel.
 - G. Structural Classification: Heavy duty meeting the requirements of ASTM C635.
 - H. Recycled Content:
 - 1. Total Content: 63-percent.
 - 2. Total Post-Consumer Content: 53-percent.
- 2.02 Suspension Materials and Fastenings: Comply with ASTM C635.
 - A. Wire: ASTM A641, galvanized steel, regular coating, soft temper; factory pre-straightened units, 12-gauge.
 - B. Wire Connections to Overhead Structures:
 - 1. Hanger Wires: Connection device capable of carrying not less than 100-pounds.
 - 2. Bracing Wires: Connection device capable of carrying not less than 200-pounds or the actual design load, whichever is greater, with a safety factor of 2 without yielding.
 - C. Fastenings for Accessories: Bolts or screws of adequate size, in types appropriate for conditions and materials involved, made of corrosion-resistant materials or coated as approved.
 - D. Compression Stiffeners: Minimum 20-gauge metal stud with 7/8-inch flange up to 4-feet in length; minimum 25-gauge metal stud with 1-5/8-inch flange and lips up to 8-feet in length.

PART 3 - EXECUTION

- 3.01 Installations shall be in accordance with manufacturers' instructions and reviewed shop drawings, and ASTM C635.
- 3.02 Waste Management: Separate and recycle waste materials to the maximum extent possible.

END OF SECTION

SECTION 09250

GYPSUM BOARD

PART 1 - GENERAL

- 1.01 This Section includes gypsum board and associated accessories.
- 1.02 Gypsum board work shall comply with ASTM C840, and California Building Code (CBC) Section 2508 unless otherwise indicated or specified.
- 1.03 Allowable Tolerances: Gypsum board surfaces shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8-inch in 10-feet when a straightedge is laid on the surface in any direction. Specified tolerances apply to both plumbness of walls and levelness of ceilings. Shim work as required to comply with specified tolerances.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: United States Gypsum, Dometar, Inc., Georgia Pacific, National Gypsum Company or approved equal.
- 2.02 Gypsum Board: United States Gypsum "SHEETROCK SW" or approved equal with tapered rounded edge to minimize ridging or beading and other joint imperfections.
 - A. ASTM C1396, regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
 - B. Thickness: 5/8-inch.
 - C. Provide Firecode C core panels where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.
- 2.03 Mold- and Moisture-Resistant Gypsum Board: United States Gypsum "SHEETROCK Mold Tough" or approved equal noncombustible, moisture- and mold-resistant gypsum core encased in moisture- and mold-resistant, 100-percent recycled face and back papers. Panels shall have a tapered long edge.
 - A. ASTM C1396, regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
 - B. Thickness: 5/8-inch.
 - C. Provide Firecode C core panels where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.
- 2.04 Screws: ASTM C954 or ASTM C1002; Type S for gypsum board attachment to light steel framing, Type S-12 for gypsum board attachment to 20-gauge and heavier steel framing, Type G for gypsum board attachment to gypsum board and Type W for gypsum board attachment to wood framing.
- 2.05 Metal Trim: Galvanized steel, 26-gauge minimum.
- 2.06 Reveals: Extruded aluminum alloy 6063-T5, profiles indicated, finish as selected by the Architect.
- 2.07 Joint-Treatment Materials: ASTM C475.
- 2.08 Reinforcing Joint Tape: ASTM C475, 2-inch nominal width.
- 2.09 Acoustical Sheet Sealant Pad: Harry A. Lowry & Associates, 3M or approved equal.
- 2.10 Primer/Surfacer: United States Gypsum "SHEETROCK" Tuff-Hide" primer-surfacer or approved equal.

PART 3 - EXECUTION

- 3.01 Apply materials in conformance with ASTM C840, the manufacturer's instructions, and as indicated.

- 3.02 For partitions, apply full height sheets with long dimension parallel to framing members with abutting edges over supports. Where ceiling heights exceed 10'-0" and where required by fire resistive ratings, apply sheets with long dimension perpendicular to framing members. For ceilings, apply sheets with long dimension either perpendicular or parallel to framing members to result in fewest joints. For fire-rated assemblies, apply gypsum board in accordance with CBC Tables 720.1(2) and 720.1(3) as applicable.
- 3.03 Acoustic Control Requirements for Sound Walls: Leave a 1/8- to 1/4-inch space between gypsum board and adjacent construction to provide a space for acoustical sealant specified in Section 07922.
- 3.04 Installation of Fasteners:
- A. Do not locate fasteners less than 3/8-inch from edges or ends of sheets. Do not locate fasteners less than one-inch from edges or ends in horizontal applications.
 - B. Fire-Rated Partitions: Install fasteners in accordance with the more restrictive of either CBC Table 720.1(2) or the Underwriters' Laboratories assemblies as denoted on partition schedule.
 - C. Non-Fire-Rated Partitions: Install fasteners in accordance with GA-216 and ASTM C840.
 - D. Fire-Rated Ceilings: Install fasteners in accordance with CBC Table 720.1(3).
 - E. Non-Fire-Rated Ceilings: Install fasteners spaced not more than 12-inches on center.
 - F. Set fastener heads slightly below surface of gypsum board, but do not break or strip paper face around fastener.
- 3.05 Installation of Accessories:
- A. Install corner trim at vertical and horizontal external corners and angles, and edge trim at junctions of gypsum board and other materials and at exposed edges.
 - B. Control Joints:
 - 1. Ceilings: Maximum area for ceilings with perimeter relief shall be 2,500-sq. ft.; maximum area for ceilings without perimeter relief shall be 900-sq. ft. Do not exceed 50-feet between control joints in ceilings with perimeter relief; 30-feet between control joints in ceilings without perimeter relief.
 - 2. Walls and Partitions: Maximum spacing between control joints shall not exceed 30-feet.
- 3.06 Finish Levels: Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214 "Recommended Specification: Levels of Gypsum Board Finish".
- A. Level 0: In areas of temporary construction, no taping or accessories are required.
 - B. Level 1: Ceiling plenum areas and concealed areas. Provide higher level of finish as required to comply with fire-resistance ratings and acoustical ratings.
 - C. Level 2: Gypsum board substrate at tile, except remove tool marks and ridges.
 - D. Level 3: Gypsum board surfaces, where textured finishes or heavy wall coverings will be used.
 - E. Level 4: Gypsum board surfaces, except where another finish level is specified.
 - F. Level 5: Not used.
- 3.07 Interior Gypsum Board Finishing:
- A. Taping (Level 1): Use taping or all purpose compound. Butter taping compound into inside corners and joints. Center tape over joints and press down into fresh compound. Remove excess compound. Tape joints of gypsum board above suspended ceilings.

- B. First Coat (Level 2): Use taping or all-purpose drying-type compound or setting-type joint compound. Immediately after bedding tape, apply skim coat of compound over body of tape and allow to dry completely in accordance with manufacturer's instructions. Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.
 - C. Second Coat (Level 3): Use all purpose or topping drying type joint compound. After first coat treatments is dried, apply second coat of compound over tape and trim, feathering compound 2-inches beyond edge of first coat.
 - D. Third Coat (Level 4): Use all purpose or topping drying type joint compound. After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2-inches beyond edge of second coat. Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, ready for application of finish.
 - E. Skim Coat (Level 5): Not used.
- 3.08 Primer/Surfacer: Complete gypsum board surface to Level 4 before applying primer-surfacer. Machine-apply with airless sprayer in conformance with manufacturer's instructions to a wet film thickness of 15- to 20-mils. Allow to dry overnight before painting.
- 3.09 Waste Management: Separate clean waste gypsum products from contaminants for recycling. Do not include wood, plastic, metal, asphalt impregnated gypsum board or any gypsum board coated with glass fiber vinyl, decorative paper, paint or other finish. Place in designated area and protect from moisture and contamination. Protect scraps and pulverized material from moisture and contamination. Clean, unpainted waste gypsum products may be recycled by returning to gypsum board manufacturer in lieu of landfill or by hauling to alternative use manufacturer in lieu of landfill. Separate metal waste and place in designated areas for recycling or reuse.

END OF SECTION

SECTION 09282

CEMENTITIOUS BACKING BOARDS

PART 1 - GENERAL

- 1.01 This Section includes cementitious backing boards behind wall tile and cementitious underlayment at floor tile.

PART 2 - PRODUCTS

2.01 Cementitious Backing Board:

- A. Approved Manufacturer: United States Gypsum Company "DUROCK Brand Cement Board" or approved equal.
- B. Material: Aggregated portland cement board with vinyl-coated, woven glass-fiber mesh embedded in back and front surfaces.
- C. Thickness: 1/2-inch and 5/8-inch.
- D. Faces: Smooth on one side, textured on other side.
- E. Edges: Formed smooth edges; square cut ends.

2.02 Cementitious Underlayment:

- A. Approved Manufacturer: United States Gypsum Company "DUROCK Underlayment" or approved equal.
- B. Material: Aggregated portland cement board with vinyl-coated, woven glass-fiber mesh embedded in back and front sides.
- C. Thickness: 5/16-inch.
- D. Edges: Formed smooth edges; square cut ends.

- 2.03 Joint Reinforcement: Glass-fiber tape, vinyl coated, open-weave tape; 2-inches wide; pressure-sensitive.

- 2.04 Fasteners: Self-drilling screws with corrosion resistant finish or as recommended for securing underlayment to access panels.

- 2.05 Setting Materials: Latex-portland cement mortar, ANSI A118.4.

- 2.06 Joint Compound: Setting type or Lightweight Setting Type Joint Compound.

PART 3 - EXECUTION

3.01 Partitions:

- A. Install blocking to support tub and other plumbing fixtures, and to receive grab bars and other accessories and hardware.
- B. Apply cementitious backing boards to framing with long dimension parallel to or across framing. Fit ends and edges closely but not forced together. Center end or edge joints on framing and stagger joints in adjacent rows.
- C. Fasten cementitious backing board to framing. Locate screws at least 3/8-inch from edge of board and 8-inches o.c.

- 3.02 Floors: Secure underlayment to access flooring panels in accordance with manufacturer's recommendations. Place underlayment with joints staggered from access panel joints. Fit ends and edges closely but not forced together. Prefill joints with tile-setting mortar or adhesive and then immediately embed tape and level joints; or apply tape over the joints and then apply tile-setting mortar or adhesive, forcing it through the tape to completely fill and level the joints.

3.03 Joint Treatment:

- A. **Tiled Surfaces:** Apply joint reinforcing over joints and corners. Embed with mortar or adhesive used to set tile.
- B. **Un-Tiled Exposed or Painted Surfaces:** Install cementitious backing board with smooth side exposed. Seal cementitious backing board with sealer. Apply tape over joints. Embed joint tape and treat fasteners with joint compound. Flat trowel a skim coat of joint compound over cementitious backing board to fill voids. Sand to provide a smooth surface except where a textured finish is indicated. Finish joints with at least two coats of finishing compound. Install corner beads at outside corners.

END OF SECTION

SECTION 09300

TILE

PART 1 - GENERAL

- 1.01 This Section includes wall tile, floor tile, and stone thresholds.
- 1.02 Floor tile shall have a minimum coefficient of friction of 0.6 determined in accordance with ASTM C1028.

PART 2 - PRODUCTS

- 2.01 Wall Tile: Manufacturer, pattern and color as indicated on the Finish Legend.
- 2.02 Floor Tile: Manufacturer, pattern and color as indicated on the Finish Legend.
- 2.03 Trim Units: Provide trim units to match adjoining flat tile. Coordinate with sizes and coursing of adjoining flat tile.
- 2.04 Latex Portland-Cement Mortar: ANSI A118.4. Mortar shall be approved for use in thin-setting ceramic tile over cold fluid-applied waterproofing specified in Section 07 14 16.
- 2.05 Commercial Portland Cement Grout: ANSI A118.6, color as selected by the Architect.
- 2.06 Dry-Set Grout: ANSI A118.6, color as selected by the Architect.
- 2.07 Latex-Portland Cement Grout: ANSI A118.6, color as selected by the Architect.
- 2.08 Chemical-Resistant Epoxy Grout: ANSI A118.3, color as selected by the Architect.
- 2.09 Grout Schedule:
 - A. Wall Tile: Commercial portland cement, dry-set, or latex-portland cement.
 - B. Floor Tile: Commercial portland cement, sand-portland cement, dry-set, latex-portland cement or epoxy.
 - C. Toilet Room Floors: Epoxy.
- 2.10 Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate.

PART 3 - EXECUTION

- 3.01 Interior Floor Tile Installation Methods:
 - A. Thin-set over Cementitious Underlayment: Install over cementitious underlayment over raised access flooring specified in Section 10270 in accordance with ANSI A108.5 using TCA Method F144, modified for access flooring.
 - B. Thin-set over Waterproofing in Toilet Rooms: Install over elastomeric membrane waterproofing in accordance with ANSI A108.5 using TCA Method F122. Waterproofing is specified in Section 07142.
- 3.02 Interior Wall Tile Installation Methods:
 - A. Thin-set over Cementitious Backing Board: Install over cementitious backing board in accordance with ANSI A108.5 using TCA Method W244.
- 3.03 Expansion Joints: Comply with TCA Method EJ171. Proposed joint locations shall be approved by the Architect.

- 3.04 Upon completion of placement and grouting, clean tile surfaces so they are free of foreign matter. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- 3.05 Waste Management: Separate waste and place in designated areas in the following categories for recycling:
- A. ½ tiles and larger, set aside for reuse by Owner, non-profit organizations such as Habitat for Humanity, etc.
 - B. Broken tile and cut offs smaller than ½ tile, excess mortar and grout, crush for use as mosaic, sub-base or fill.
 - C. Separate metal waste and place in designated areas for recycling or reuse.
 - D. Separate cardboard waste and place in designated areas for recycling.

END OF SECTION

SECTION 09511
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

- 1.01 This Section includes acoustical ceiling panels.
- 1.02 Warrant acoustical ceiling panels to be free from visible sag and against mold, mildew and bacteria for a period of 30-years from Date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Acoustical Panels ACT-1:
 - A. Approved Manufacturers: Armstrong "Cirrus Beveled Tegular" Item No. 589B or approved equal.
 - B. Material: Mineral fiber, wet-formed.
 - C. Typical Field Size: Nominal 24- x 24-inches, 3/4-inches thick.
 - D. Edges: Beveled Tegular.
 - E. NRC: .70, in accordance with ASTM C423.
 - F. CAC: Minimum 35, in accordance with ASTM E1414.
 - G. Acoustics AC: N/A.
 - H. Flame Spread Classification: Class A.
 - I. Light-Reflectance: 0.86.
 - J. Finish and Color: Factory-applied white acrylic latex finish.
 - K. Acoustical panels shall have antimicrobial treatment on front face.
 - L. Total Recycled Content: 63- to 71-percent.
 - M. VOC Formaldehyde: No added.

PART 3 - EXECUTION

- 3.01 Building shall have been entirely enclosed and heated not less than 10-days before start of suspended-ceiling work. Before installation, acoustical units shall have been stored within the spaces where they are to be used for not less than 3-days, and with cartons opened and stripped sufficiently to permit units to stabilize to ambient conditions.
- 3.02 Install acoustical panels in suspended grid system in accordance with manufacturer's instructions.
- 3.03 Field-cut edges of tegular edge acoustical panels shall be routed to match the edge profile of uncut panels so that panels lay in grid system flush with adjacent un-cut panels and edges of cut panels match the appearance of uncut panels.
- 3.04 Touch-up edges to match factory cut panels.
- 3.05 Waste Management: Separate waste and place in designated areas in the following categories for recycling:
 - A. 1/2 panels and larger, set aside for reuse by Owner, non-profit organizations such as Habitat for Humanity, etc.
 - B. Place scrap panels in designated areas for recycling or reuse.

- C. Separate cardboard waste and place in designated areas for recycling.

END OF SECTION

SECTION 09652

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

- 1.01 This Section includes resilient wall base, resilient flooring accessories and resilient carpet accessories.
- 1.02 Fire Performance Characteristics:
 - A. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.
 - B. Smoke Density: Less than 450 per ASTM E662.

PART 2 - PRODUCTS

- 2.01 Vinyl Wall Base:
 - A. Style:
 - 1. VB1: Cove with top-set toe for use with resilient flooring.
 - 2. CB1: Straight with no toe for use with carpet tile.
 - B. Height: 4-inches.
 - C. Lengths: Coils in lengths standard with manufacturer but not less than 100-feet.
 - D. Exterior and Interior Corners: Premolded.
 - E. Ends: Premolded.
 - F. Manufacturer, Pattern, and Color: As indicated on the Finish Legend.
- 2.02 Provide carpet edge for glue down applications, reducer strip for resilient flooring, and tile/carpet transition strips. Color as selected by the Architect from manufacturer's standards.
- 2.03 Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- 2.04 Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- 2.05 Adhesives: Provide type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.

PART 3 - EXECUTION

- 3.01 Install products specified in this Section using methods indicated according to manufacturer's installation directions.
- 3.02 Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates. Install inside and exterior corners before installing straight pieces.
- 3.03 Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.
- 3.04 Waste Management: Close and seal tightly all partly used adhesive containers and store protected in well ventilated fire-safe area at moderate temperatures. Place used adhesive tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 09656
RESILIENT TILE FLOORING

PART 1 - GENERAL

- 1.01 This Section includes resilient tile flooring.
- 1.02 Fire Performance Characteristics:
 - A. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.
 - B. Smoke Density: Less than 450 per ASTM E662.
- 1.03 Slip Resistant Surfaces: Conform to the more restrictive provisions of Title III of the Americans with Disabilities Act or with California Building Code (CBC). Resilient flooring shall have a coefficient of friction of at least 0.6 per ASTM D2047.

PART 2 - PRODUCTS

- 2.01 Resilient Tile Flooring: Manufacturer, pattern, color as indicated on the Finish Legend.
- 2.02 Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- 2.03 Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.
- 2.04 Adhesives: Provide type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.
- 2.05 Chemical-Bonding Compounds: Manufacturer's product for chemically-bonding seams.

PART 3 - EXECUTION

- 3.01 Comply with tile manufacturer's installation directions and other requirements applicable to each type of tile installation.
- 3.02 Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.
- 3.03 Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles. Lay tiles with grain running in one direction unless otherwise indicated or directed by the Architect.
- 3.04 Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended by tile manufacturer.
- 3.05 Waste Management:
 - A. Separate waste and place full size tiles for re-use.
 - B. Linoleum and cork, if used, are biodegradable and may be shredded and composted.
 - C. Close and seal tightly all partly used adhesive containers and store protected in well-ventilated fire-safe area at moderate temperatures. Place used adhesive tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 09682

TILE CARPETING

PART 1 - GENERAL

- 1.01 This Section includes tile carpeting.
- 1.02 Fire Hazard Classification: Class I floor finish. Minimum critical flux limit of 0.45-watts/square centimeter when tested in accordance with NFPA 253.
- 1.03 Comply with CRI – Carpet and Rug Institute Indoor Air Quality Green Label Testing Program.
 - A. All carpet tile products shall comply with the VOC limit established by the Carpet and Rug Institute (CRI) Green Label Indoor Air Quality Test Program.
- 1.04 Warrant the carpet tile to be free of defects for a period of 5-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Carpet Tile: Manufacturer, pattern and color as indicated on the Finish Legend.
- 2.02 Carpet Adhesive: XL Brands/Interface "Grid-Set Green Glue 2000" or approved equal pressure-sensitive acrylic emulsion, solvent-free, meeting or exceeding CRI "Green Label" requirements, as recommended by carpet tile manufacturer.
- 2.03 Crack Filler: Latex base type.

PART 3 - EXECUTION

- 3.01 Apply carpet tiles in strict accordance with manufacturer's instructions.
- 3.02 Cement carpet tiles directly to floor. Cut evenly along walls, cut and fit evenly around projections, corners, pipes, electrical outlets, floor air or heating elements, and trim strips.
- 3.03 Leave carpet base and walls clean and free from stains, blemishes and other foreign material. Remove loose threads and vacuum clean. Installation shall not receive furniture or heavy traffic for 48-hours after installation.
- 3.04 Waste Management: All scraps of unused material shall be reclaimed and recycled by the carpet tile manufacturer. Include a detailed confirmation of the material received by the manufacturer and documentation that these materials have been recycled into new flooring materials. No incineration of reclaimed materials is acceptable.

END OF SECTION

SECTION 09688

SHEET CARPETING

PART 1 - GENERAL

- 1.01 This Section includes sheet carpet and accessories.
- 1.02 Fire Hazard Classification: Class I floor finish. Minimum critical flux limit of 0.45-watts/square centimeter when tested in accordance with NFPA 253.
- 1.03 Comply with CRI – Carpet and Rug Institute Indoor Air Quality Green Label Testing Program.
 - A. All carpet products shall comply with the VOC limit established by the Carpet and Rug Institute (CRI) Green Label Indoor Air Quality Test Program.
- 1.04 Warrant the surface pile against abrasive wear of more than 10-percent within 10-years for carpet as properly installed and maintained. Misuse, damage, or improper cleaning methods shall not apply. Warrant installation against stretching, wrinkling, opening of joints, and other areas of poor materials and workmanship for a period of 2-years after final acceptance of Project.

PART 2 - PRODUCTS

- 2.01 Sheet Carpeting: Manufacturer, pattern and color as indicated on the Finish Legend.
- 2.02 Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- 2.03 Carpet Adhesive: Water-resistant, non-staining type as recommended by carpet manufacturer, complying with flammability requirements for installed carpet. VOC content meeting or exceeding CRI "Green Label" requirements.
- 2.04 Miscellaneous: Provide tape, thread, and other items necessary for installation.

PART 3 - EXECUTION

- 3.01 Comply with manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile.
- 3.02 Glue-Down Installation:
 - A. Fit sections of carpet into each space prior to application of adhesive. Trim edges and butt cuts with seaming cement.
 - B. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps.
 - C. Roll lightly to eliminate air pockets and ensure uniform bond.
- 3.03 Waste Management: All scraps of unused material shall be reclaimed and recycled by the carpet tile manufacturer. Include a detailed confirmation of the material received by the manufacturer and documentation that these materials haven recycled into new flooring materials. No incineration of reclaimed materials is acceptable.

END OF SECTION

SECTION 09820
ACOUSTIC INSULATION

PART 1 - GENERAL

- 1.01 This Section includes acoustic insulation in all full-height walls and above ceilings where indicated.

PART 2 - PRODUCTS

- 2.01 Formaldehyde-Free Unfaced Mineral/Glass Fiber Blanket/Batt Acoustical Insulation: Acoustical insulation produced by combining glass fibers with formaldehyde-free thermosetting resins to comply with ASTM C665, Type I.
- A. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50 when tested in accordance with ASTM E84.
 - B. Approved Manufacturers: Johns Manville "Formaldehyde-Free Sound Control Fiber Glass Batts" or approved equal.
 - C. Thickness: 3-inches.

PART 3 - EXECUTION

- 3.01 Comply with manufacturer's instructions for installation conditions.
- 3.02 Do not install insulation until building is sufficiently enclosed or protected against absorption of moisture by the insulation, and do not install insulation unless supporting framing and construction is in a thoroughly dry condition.
- 3.03 Install snugly between framing members with ends snugly fitted between units and against adjacent construction. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.
- 3.04 Install over suspended acoustical ceiling panels where indicated.
- 3.05 Waste Management: Plan and coordinate the insulation work to minimize the generation of offcuts and waste. Remove insulation scraps to the maximum extent feasible. Separate and recycle waste materials to the maximum extent possible.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

- 1.01 This Section includes painting and finishing of interior exposed items and surfaces.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, Benjamin Moore, Dunn Edwards, Frazee, ICI, Sherwin Williams, Vista or approved equal.

- A. Benjamin Moore, Dunn Edwards, Frazee and Sherwin Williams products are specified as a standard of quality against which the equivalency of other products will be determined by the Architect.

- 2.02 Colors: Match colors scheduled on the Finish Legend.

PART 3 - EXECUTION

- 3.01 Examine substrates and conditions under which painting is to be applied. Surfaces receiving paint shall be thoroughly dry before paint is applied.

- 3.02 Protection: Protect work of other Sections against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

- 3.03 Surface Preparation:

- A. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
- B. Ferrous Metal: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of The Society for Protective Coatings (SSPC).
- C. Galvanized Metals: Clean with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Gypsum Wallboard: Clean surfaces of dust, dirt, grease, oil and other foreign matter and dust clean.

- 3.04 Mix and prepare painting materials in accordance with manufacturer's directions. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and strain material before using.

- 3.05 Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

- 3.06 Application: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied. Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

- 3.07 Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.

- 3.08 Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections will not be acceptable.

- 3.09 Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

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3.10 Interior Paint Schedule:

		BENJAMIN MOORE	DUNN-EDWARDS	FRAZEE	SHERWIN WILLIAMS
A.	Wood, Low Odor/Zero VOC Acrylic Semigloss				
	First Coat	Eco Spec Latex Primer Sealer #231	W600 Ecoshield Primer	066 Envirokote Primer	B51 Series PrepRite ProBlock Latex
	Second and Third Coats	Eco Spec Latex Semi-Gloss #224	W603 Ecoshield SG	032 Envirokote SG	B31-600 Series ProGreen 200 Interior Latex Semi-Gloss
B.	Wood, Clear Satin Finish				
	First Coat	Benwood Quick Dry Sanding Sealer #413	LQ 150-0 550 Crystaclear Sanding Sealer	Varathane Diamond Waterbased Finish	A68V91 Wood Classics WB Polyurethane Varnish Gloss
	Second and Third Coats	Benwood Acrylic Polyurethane Low Lustre #423	LQ 154 550 Crystaclear	Varathane Diamond Waterbased Finish	Wood Classics WB Polyurethane Varnish, Satin
C.	Wood, Stain and Satin Finish				
	First Coat	Benwood Penetrating Stain #234	V 109 Stainseal II	ZAR Wood Stain	Minwax 250 Oil Stain
	Second Coat	Benwood Quick Dry Sanding Sealer #413	LQ 150-0 550 Crystaclear Sanding Sealer	Varathane Diamond Waterbased Finish	A68V91 Wood Classics WB Polyurethane Varnish Gloss
	Third Coat	Benwood Acrylic Polyurethane Low Lustre #423	LQ 154 550 Crystaclear	Varathane Diamond Waterbased Finish	Wood Classics WB Polyurethane Varnish, Satin
	Fourth Coat	Benwood Acrylic Polyurethane Low Lustre #423	LQ 154 550 Crystaclear	—	—
D.	Gypsum Wallboard, Low Odor/Zero VOC Acrylic Flat				
	First Coat	Pristine Eco Spec Latex Primer Sealer #231	W 600 Ecoshield Primer	066 Envirokote Primer	B28W600 Series ProGreen 200 Interior Latex Primer
	Second and Third Coats	Eco Spec Latex Flat #219	W 601 Ecoshield Flat	018 Envirokote FL	B30W200 Series ProGreen 200 Interior Latex Flat
E.	Gypsum Wallboard, Low Odor/Zero VOC Acrylic Low Sheen/Eggshell				
	First Coat	Pristine Eco Spec Latex Primer Sealer #231	W 600 Ecoshield Primer	066 Envirokote Primer	B28W600 Series ProGreen 200 Interior Latex Primer
	Second and Third Coats	Eco Spec Latex Eggshell #223	W 602 Ecoshield LS	029 Envirokote EG	B20W651 Series ProGreen 200 Interior Latex Eg-Shell
F.	Gypsum Wallboard, Low Odor/Zero VOC Acrylic Semigloss				
	First Coat	Pristine Eco Spec Latex Primer Sealer #231	W 600 Ecoshield Primer	066 Envirokote Primer	B28W600 Series ProGreen 200 Interior Latex Primer
	Second and Third Coats	Eco Spec Latex Semi-Gloss #224	W 603 Ecoshield SG	032 Envirokote SG	B31-600 Series ProGreen 200 Low VOC Semi-Gloss
G.	Gypsum Wallboard, Epoxy Semigloss				
	First Coat	Pristine Eco Spec Latex Primer Sealer #231	—	061 Aqua Seal Wall Sealer	PrepRite 200 Latex Primer
	Second and Third Coats	Super Spec HP Acrylic Epoxy Glass #P43/P43-84	—	Amercoat 335	K46 Series Pro Industrial Pre-Catalyzed WB Epoxy
H.	Ferrous Metal, Low Odor/Zero VOC Acrylic Semigloss				
	First Coat	Super Spec Metal Primer #P04	43-7 GALV-ALUM	561 Acrylic Primer	B66-310 Series Pro-Cryl Primer
	Second and Third Coats	Eco Spec Latex Semi-Gloss #224	W 603 Ecoshield SG	032 Envirokote SG	B31-600 Series ProGreen 200 Low VOC Semi-Gloss
I.	Non-Ferrous Metal, Low Odor/Zero VOC Semigloss				
	First Coat	Fresh Start Acrylic Primer #023	43-7 Galv-Alum	561 Acrylic Metal Primer	B66-310 Series Pro-Cryl Primer
	Second and Third Coats	Eco Spec Latex Semi-Gloss #224	W 603 Ecoshield SG	032 Envirokote SG	B31-600 Series ProGreen 200 Interior Latex Semi-Gloss

3.11 Waste Management:

- A. Set aside extra paint for future color matches, or reuse by Owner. Habitat for Humanity, etc. Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.
- B. Close and seal tightly all partly used paint and finish containers and store protected in well-ventilated fire-safe area at moderate temperatures. Place empty containers of solvent based paints in areas designated for hazardous materials. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.

END OF SECTION

SECTION 10100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

- 1.01 This Section includes the following types of visual display surfaces:
- A. Aluminum-framed markerboards. Provide one in each office, conference room and classroom.
- 1.02 Warrant markerboards to be free from defects in materials and workmanship for the life of the building.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Aywon Chalkboard & Corkboard, Inc., Claridge Products and Equipment, Inc., Marsh Industries, Polyvision or approved equal.
- 2.02 Porcelain Enamel Markerboards:
- A. Face Sheet: Enameling grade cold rolled steel manufactured from a minimum of 30-percent post-consumer and post-industrial waste. Enameling grade steel shall be coated with a 3-coat process. Color as selected by the Architect from manufacturer's standards.
 - B. Core: 7/16-inch thick medium density fiberboard (MDF) composed of approximately 90-percent post-industrial waste.
 - C. Backing Surface: Moisture barrier, foil, aluminum sheet or steel.
 - D. Metal Trim and Accessories: Minimum 0.062-inch thick aluminum. Provide straight, single-length units wherever possible. Miter corners to a neat, hairline closure.
 - 1. Field-Applied Trim: Manufacturer's standard snap-on or slip-on trim, with no visible screws or exposed joints.
 - 2. Chalktray: Manufacturer's standard continuous solid extrusion-type with ribbed section and smoothly curved exposed ends.
 - 3. Finish aluminum trim and accessories with clear anodized finish.
 - 4. Furnish each markerboard with 12 assorted color markers and a felt eraser.

PART 3 - EXECUTION

- 3.01 Deliver factory-built units completely assembled in one piece without joints.
- 3.02 Install units as indicated and in accordance with manufacturer's instructions. Maintain perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories required for installation.
- 3.03 Clean units in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10160

TOILET COMPARTMENTS

PART 1 - GENERAL

- 1.01 This Section includes plastic-laminate-faced toilet compartments configured as toilet enclosures and urinal screens.
- 1.02 Shop Drawings: Include plans, elevations, sections, details and attachments to other work. Show locations of cutouts for compartment-mounted toilet accessories. Show locations of reinforcements for compartment-mounted grab bars.
- 1.03 Surface-Burning Characteristics: Flame-spread index of 25 or less; smoke-developed index of 450 or less, as determined by testing identical products according to ASTM E84.
- 1.04 Regulatory Requirements: Comply with Americans with Disabilities Act (ADA) and California Building Code (CBC) requirements.

PART 2 - PRODUCTS

- 2.01 Materials:
 - A. Particleboard: ANSI A208.1, Grade M-2 with 45-lb. density, made with binder containing no urea formaldehyde.
 - B. Plastic Laminate: NEMA LD-3, general-purpose HGS grade, 0.048-inch nominal thickness, color and pattern as selected by Architect from manufacturer's standards.
- 2.02 Plastic-Laminate-Faced Units:
 - A. Approved Manufacturers: Superior Partitions Inc. "Supreme Series", Accurate Partitions Corporation, All American Metal Corp., Ampco, Inc., Bobrick Washroom Equipment, Inc., Global Steel Products Corp., Knickerbocker Partition Corporation, Sanymetal, Weis-Robart partitions, Inc. or approved equal.
 - B. Toilet Enclosure Style: Overhead braced.
 - C. Urinal-Screen Style: Wall hung.
 - D. Door, Panel, Screen and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facing or cores; with laminate applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.
 - 1. Core Material: Particleboard.
 - 2. Door and Panels: Finished to not less than 1-inch thick.
 - 3. Pilasters: Provide construction to comply with one of the following:
 - a. Finished to not less than 1-1/4-inches thick and with internal, nominal 0.134-inch thick steel-sheet reinforcement.
 - b. Finished to 1-1/4-inches thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.

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- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 22-gauge and 3-inches high, finished to match hardware.
 - F. Brackets (Fittings): Either stainless steel Ear or U-brackets or stainless steel full-height continuous fittings.
 - G. Plastic-Laminate Finish: Color and pattern as selected by the Architect from manufacturer's full range of colors, including premium colors.
- 2.03 Hardware and Accessories: Manufacturer's standard Zamac coated steel, heavy duty operating hardware and accessories.
- A. Hinges: Paired, self-closing type that can be adjusted to hold doors open at any angle up to 90-degrees.
 - B. Latch and Keeper: Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - C. Coat Hook: Combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - D. Door Bumper: Rubber-tipped bumper at out-swinging doors.
 - E. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- 2.04 Overhead Bracing: Continuous, extruded-aluminum head rail with anti-grip profile, satin anodized finish.
- 2.05 Anchorages and Fasteners: Stainless steel exposed fasteners finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.
- 2.06 Overhead-Braced Units: Provide corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- 2.07 Door Size and Swings: Unless otherwise indicated, provide 24-inch wide, in-swinging doors for standard toilet compartments and 36-inch wide, out-swinging doors with a minimum 32-inch wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

- 3.01 Install units rigid, straight, plumb, and level. Secure units in position with manufacturer's recommended anchoring devices.
- 3.02 Provide clearances of not more than 1/2-inch between pilasters and panels, and not more than 1-inch between panels and walls.
- 3.03 Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

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- 3.04 Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten installation. Set pilasters with anchors penetrating not less than 1-3/4-inches into structural floor. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so that tops of doors are parallel with overhead-brace when doors are in closed position.
- 3.05 Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.
- 3.06 Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30-degrees from closed position when unlatched. Set hinges on out-swinging doors and entrance swing doors to return to fully closed position.
- 3.07 Clean exposed surfaces of partitions using materials and methods recommended by manufacturer. Protect as required to prevent damage until final acceptance.

END OF SECTION

SECTION 10270
ACCESS FLOORING

PART 1 - GENERAL

- 1.01 This Section describes the requirements for furnishing and installing the following:
- A. Bolted panels, stringerless understructure.
- 1.02 System Performance:
- A. Structural Performance:
 - 1. Concentrated Load: 1,250-lbs. on 1-sq. inch at any location with a top-surface deflection under load and a permanent set not to exceed, respectively, 0.010-inch and 0.010-inch.
 - 2. Uniform Load: 600-psf with a maximum top surface deflection not to exceed 0.040-inch and a permanent set not to exceed 0.010-inch.
 - 3. Ultimate Loads: 1,800-psf minimum at weakest point.
 - 4. Rolling Loads: Provide access flooring systems capable of withstanding rolling loads of the following magnitude, with a combination of local and overall deformation not to exceed 0.040-inch after exposure to rolling load over CISC A/F Path A or B, whichever path produces the greatest top-surface deformation, according to CISC A/F, Section III, "Rolling Loads".
 - a. CISC A/F Wheel 1 Rolling Load: 1,200-lb.
 - b. CISC A/F Wheel 2 Rolling Load: 800-lb.
 - 5. Pedestal Axial Load Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding a 5,000-lb. axial load per pedestal, according to CISC A/F, Section V, "Pedestal Axial Load Test".
 - 6. Pedestal Overturning Moment Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding an overturning moment per pedestal of 1,000-lb. x inches, according to CISC A/F, Section VI, "Pedestal Overturning Moment Test".
 - B. Floor Panel Impact-Load Performance: Provide access flooring system capable of withstanding an impact load of 150-lb. when dropped from 36-inches onto a 1-sq. in. area located anywhere on panel, without failing. Failure is described as collapse of access flooring system.
 - C. Seismic Performance: Provide access flooring system capable of withstanding the effects of seismic motions determined according to California Building Code (CBC) requirements.
- 1.03 Shop Drawings: Show complete layout of access flooring based on field-verified dimensions; include dimensional relationships to adjoining work. Include full size details; indicate materials, finishes, fasteners, edge conditions, accessories, understructure and other pertinent data.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: ASM Modular Floors, Inc., Computer Environments, Inc., Haworth, Interface AR, Maxcess Technologies, Inc., Tate Access Floors, Inc. or approved equal.
- 2.02 Floor Panels: Provide modular panels complying with the following requirements that one person, using a portable lifting device, can interchange with other field panels without disturbing adjacent panels or understructure:
- A. Nominal Panel Size: 24-inch x 24-inch.
 - B. Panel Attachment to Understructure: By bolting to pedestal head. Provide panels with holes drilled in corners to align with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
 - C. Cementitious-Filled, Formed Steel Panels: Fabricated with die-cut flat top sheet and die-formed and stiffened bottom pan formed from cold-rolled steel sheet joined together by resistance welding to form an enclosed assembly, with metal surfaces protected against corrosion by factory-applied finish. Fully grout internal spaces of completed units with cementitious fill.
 - D. Floor Panel Covering:
 - 1. Carpet tile as specified in Section 09682.
 - 2. Ceramic tile over cementitious underlayment as specified in Section 09300.
 - 3. Resilient tile as specified in Section 09656.
- 2.03 Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head: made of hot-dip galvanized steel.
- A. Provide pedestals designed for use in seismic applications.
 - B. Base: Square or circular with not less than 16-sq. in. of bearing area.
 - C. Column: Height required to bring finished floor to elevations indicated. Weld to base plate.
 - D. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2-inches and for locking at a selected height, so deliberate action is required to change height setting and vibratory displacement is prevented.
 - E. Head: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.
- 2.04 Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.
- 2.05 Modular Wiring System: As specified in Section 16125.
- 2.06 Cutouts: Fabricate panel cutouts to accommodate cable penetrations and service outlets. Provide reinforcement or additional support if required. Fit cutouts with manufacturer's standard grommets or trim edge of cutouts with manufacturer's standard plastic molding.
- 2.07 Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels, for power, communication, and signal services.

- 2.08 Ramps: Manufacturer's standard ramp construction of width and slope indicated but not steeper than 1:12, with non-slip raised disc rubber or vinyl floor covering, of same materials, performance, and construction requirements as access flooring.
- 2.09 Railings: Manufacturer's standard satin-finished extruded aluminum post- and rail-type railings, at ramps and open-sided perimeter of access flooring. Include handrail, intermediate rails, posts, brackets, end caps, wall returns, wall and floor flanges, plates and anchorages required.
- 2.10 Panel Lifting Device: Manufacturer's standard portable lifting device of type required. Provide one lifting device per room of each type required.
- 2.11 Perimeter Support: Provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

PART 3 - EXECUTION

- 3.01 Pre-Installation Adhesive Subfloor Field Test: Prior to proceeding with installation of pedestals, field test their adhesion to subfloor surfaces.
- 3.02 Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6-inches.
- 3.03 Install access floor system and accessories under supervision of the manufacturer's authorized representative to ensure rigid, firm installation free of vibration, rocking, rattles, squeaks, and other unacceptable performance.
- 3.04 Set pedestals in adhesive as recommended by the access flooring manufacturer to provide full bearing of the pedestal base on the subfloor. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.
- 3.05 Install floor panels securely in place, properly seated with panel edges flush. Do not force panels into place.
- 3.06 Clean dust, dirt, and construction debris caused by floor installation and vacuum subfloor area, as installation of floor panels proceeds.
- 3.07 Install access flooring without change in elevation between adjacent panels and within the following tolerances:
 - A. Plus or minus 1/16-inch in any 10-foot distance.
 - B. Plus or minus 1/8-inch from a level plane over entire access flooring area.
- 3.08 Prohibit traffic on access flooring for 24-hours and removal of floor panels for 72-hours after installation to allow pedestal adhesive to set. After completion of installation, vacuum clean the entire floor system and cover with continuous sheets of reinforced paper or plastic. Maintain and repair damages to protective covering until directed by Architect.

END OF SECTION

SECTION 10400

SIGNAGE

PART 1 - GENERAL

1.01 This Section includes the specified signage.

- A. Non-code required signage not specified in this Section will be furnished under an allowance as specified in Section 01210.

1.02 Comply with California Building Code (CBC) Section 1117B.5.

PART 2 - PRODUCTS

2.01 General Interior Signage Requirements:

- A. Signs shall be sign manufacturer's standard one piece photopolymer sign face with tactile Braille and letters or acrylic sign face with applied tactile lettering and Braille, at manufacturer's option, and shall be interior rated.
- B. Sign materials and fabrication shall comply with applicable CBC and ADA signage requirements.
- C. Sign Finish: Eggshell, matte, or non-glare as selected by the Architect.
- D. Copy: 5/8-inch minimum, 2-inch maximum as recommended by sign manufacturer for required copy, raised minimum 1/32-inch.
- E. Letters: Style as indicated or as selected by the Architect.
- F. Braille: Contracted Grade 2 Braille complying with CBC Section 1117B.5.6.
- G. Mounting: Vinyl foam tape unless mechanical fasteners are indicated.

2.02 Vinyl Letters and Numbers:

- A. Form individual letters, numbers and business logo from vinyl in a design, font and color as directed by the Owner.
- B. Provide computer-cut characters with sharp corners, and precisely formed lines and profiles.

2.03 Toilet Room Entry Signs:

- A. Provide geometric acrylic plastic symbols as follows. Colors as selected by the Architect.
 - 1. Men: 12-inch equilateral triangle with international symbol for men.
 - 2. Women: 12-inch diameter circle with international symbol for women.
 - 3. Unisex: 12-inch diameter circle with 12-inch equilateral triangle.
 - 4. Comply with CBC Section 1115B.6 and ADA Article 4.30.
- B. Provide sign with raised letters and Braille on the wall adjacent to the latch outside the door. Where there is no wall space on the latch side and at double leaf doors, provide sign on nearest adjacent wall. Comply with CBC Section 1117B.5.1.1.
- C. Center geometric symbols on door and signs on wall at a height of 60-inches above finished floor.

2.04 Room Identification Signs:

- A. Provide one sign adjacent to latch side of doors or on the nearest adjacent wall where indicated. Signs shall identify room name as directed by the Architect.

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- B. Provide signs with raised upper case letters with Grade 2 Braille. Comply with ADA Article 4.30.
- C. Mount signs 60-inches above finish floor to centerline of sign.
- D. Comply with CBC Section 1117B.5.1.1.

2.05 Suite Identification Signs:

- A. Provide one sign adjacent to latch side of suite entry door. Vinyl letter type signage shall be applied to exterior surface of exterior glazing for both the EDA and HOC spaces.
- B. Provide signs with suite address, business name, hours of operation and basic business logo. Business logos are attached at the end of this Section.

1100 Broadway
Housing Opportunities Collaborative
Housing Resource Center
Hours of Operation
M-F 9:00 a.m. to 5:00 p.m.

1045 11th Street
Economic Development Academy
Hours of Operation
M-F 8:00 a.m. to 5:00 p.m.

- C. Family Justice Center: Owner-furnished, Contractor-installed.

PART 3 - EXECUTION

- 3.01 Locate where indicated and as required by applicable codes and secure with specified fasteners.
- 3.02 Install level, plumb and at height indicated or required, with surfaces free from distortion or other appearance defects.

END OF SECTION

SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

- 1.01 This Section includes fire extinguishers, fire extinguisher cabinets.
- 1.02 UL-Listed Products: Provide fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher specified.
- 1.03 Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

PART 2 - PRODUCTS

- 2.01 Fire Extinguishers:
 - A. General: Provide fire extinguishers for each extinguisher cabinet. Comply with requirements of governing authorities. Fire extinguishers shall be full charged and tagged in accordance with requirements of the authority having jurisdiction.
 - B. Multi-Purpose Dry Chemical Type: UL-rated 2A:10BC, 5-lb. nominal capacity, in enameled steel container.
- 2.02 Fire Extinguisher Cabinets:
 - A. Approved Manufacturers: J.L. Industries, Larsen's Manufacturing Co., Potter-Roemer, Inc. or approved equal.
 - B. Tub: Heavy-gauge, white baked enamel. Where fire extinguisher cabinets are installed in fire-rated partitions, provide cabinet walls fabricated from 0.0428-inch thick, cold-rolled steel sheet lined with minimum 5/8-inch thick fire-barrier material. Provide factory-drilled mounting holes.
 - C. Cabinet Type: Semi-recessed.
 - D. Trim Style: Exposed trim, either square-edge or rolled-edge as standard with manufacturer for cabinet type and depth.
 - E. Door Material: Manufacturer's standard enameled steel.
 - F. Door Glazing: Clear tempered float glass.
 - G. Door Style: Full-glass panel.
 - H. Door Hardware: Manufacturer's standard door operating hardware for cabinet type, trim style, and door material and style specified. Provide door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180-deg.

PART 3 - EXECUTION

- 3.01 Install items in locations and at mounting heights to comply with applicable regulations of governing authorities.

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- 3.02 Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim in compliance with manufacturer's instructions.
- 3.03 Securely fasten fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

END OF SECTION

SECTION 10615

DEMOUNTABLE PARTITION SYSTEM

PART 1 - GENERAL

- 1.01 This Section includes demountable partition system, including the following items:
- A. Partition framing system.
 - B. Unitized solid removable face panels, aluminum framed.
 - C. Unitized glazed panels, aluminum framed.
 - D. Sliding glass doors and hardware.
 - E. Swinging glass doors and hardware.
 - F. Provision for power and communication systems within solid panels.
- 1.02 Shop Drawings: Indicate demountable partition layout, panel joint locations, connection to adjacent construction, and details.
- 1.03 Warrant demountable partition system to be free from defects in materials and workmanship for a period of 2-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: DIRT Environmental Solutions "DIRT Wall System" or approved equal.
- 2.02 System Description:
- A. Unitized solid wall system shall have components which can be disassembled, relocated, and reused. System shall consist of vertical MDF face panels with finish as indicated or selected. Integrated accessory channels shall be designed into the structural frame allowing for accessible power and data; hang on accessories, storage and furniture component bearing. Panel shall provide aluminum or veneer wrapped aluminum leveling floor base, top rail for stand alone or ceiling track attached top track, hidden or visible zippers for panel to panel connections, trim and accessories. Wall panel shall be 4-inches thick and provide 2-inch wide cavity for distribution of utilities accessed from either side of wall via removable face tiles. Interior frame shall be unitized aluminum assembly to accept face tiles and hang-on components.
 - B. Unitized glazed wall panels shall be shipped to the site fully assembled and shall integrate with solid panels using universal connector. Glazing shall consist of tempered 3/8"-inch thick glass. Frame shall be aluminum or veneer wrapped to match solid wall system.
 - C. Unitized wall system shall accommodate the installation of system furniture.
- 2.03 Performance Requirements:
- A. Solid panels shall have a flame spread index less than 75 and a smoke developed index less than 450 when tested in accordance with ASTM E84.
 - B. Sound Transmission Classification (STC): 44, tested in accordance with ASTM E90 by an independent agency and classified in accordance with ASTM E413 for solid faced panels.
 - C. Transverse Load: 5-psf.
 - C. Seismic Requirements: Comply with California Building Code (CBC).
- 2.04 Solid Wall Tile Panels: 1/2-inch thick melamine-covered fiberboard that complies with ASTM C208. The panels shall have plastic clips on the back for connection to vertical posts.
- 2.05 Framing Members: 6063-T54 extruded aluminum alloy.
- 2.06 Ceiling and Base Track: 6063-T54 extruded aluminum alloy.

- 2.07 Trim: Edges of the wall system shall be protected with extruded aluminum base trim.
- 2.08 Glass Retainer: Rigid or flexible co-extrusions as recommended by the manufacturer.
- 2.09 Glass: 3/8-inch thick clear or obscure tempered float glass, as indicated.
- 2.10 Sliding Glass Doors: Stile and rail aluminum doors with 3/8-inch thick clear tempered float glass, complete with hardware.
- 2.11 Swinging Glass Doors: Stile and rail aluminum doors with 3/8-inch thick clear tempered float glass, complete with hardware.
- 2.12 Fasteners: As recommended by demountable partition system manufacturer.
- 2.13 Modular Wiring System: Coordinate with modular wiring system installed in the demountable partition system. Modular wiring system is specified in Section 16125.

PART 3 - EXECUTION

- 3.01 Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines. Provide proper support and anchor securely in place.
- 3.02 Mechanically attach base and ceiling tracks. Carpet grippers may be used to attach base track to carpet tile.
- 3.03 Attach leveling devices to the base track. Base track shall be connected to vertical posts by engaging the plastic horizontal clips located on the ends of the tracks over the horizontal connector bolts set in the vertical post.
- 3.04 Attach solid panels to vertical posts in accordance with manufacturer's instructions using connectors.
- 3.05 Adjust operating hardware to function properly for smooth operation without binding.

END OF SECTION

SECTION 10652

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

- 1.01 This Section includes manually operated, acoustically rated folding panel partition assemblies.
 - A. Work includes design, deferred submittals, and installation of the structural support required for support of the folding panel partitions.
- 1.02 Fire Performance Characteristics: Provide folding panel partitions with surface burning characteristics specified, as determined by testing assembled materials composed of surface coverings, backings, and other construction identical to those required in this Section, in accordance with ASTM E84.
 - A. Flame Spread: 25 or less.
 - B. Smoke Developed: 450 or less.
- 1.03 Acoustical Performance: Folding panel partition assembly shall have been tested in a full-scale opening for laboratory sound transmission loss performance in accordance with ASTM E90, determined by ASTM E413 and rated for a STC of 50, plus or minus 1.
- 1.04 Shop Drawings: Show location and extent of folding panel partitions. Include plans, elevations, large-scale details of anchorages, and accessory items. Show unit conditions at openings, typical and special details, and location and installation requirements for hardware.
- 1.05 Warrant folding panel partitions to be free from defects in materials and workmanship for a period of 2-years from date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Modernfold "Acousti-Seal 900 Series", Hufcor or approved equal.
- 2.02 Panel Construction:
 - A. Panel Configuration: Series of individual panels equipped with vertical ball-bearing wheels, curves, diverters, and switches for free-flowing operation.
 - B. Panel Operation: Manual.
 - C. Suspension System: Heavy-duty track suspended from overhead structural steel beam by adjustable steel hanger rods; heavy-duty trolley system panel supports designed for use with size and type of wall system specified. Attach trolleys to panels with adjustable pendant bolts. Multi-directional "puck" type trolley assemblies are not permitted.
 - 1. Coordinate partition weight and required beam size with the Contractor.
 - D. Panel Construction:
 - 1. Factory-fabricated panels of minimum 24-gauge steel face sheets welded to minimum 18-gauge steel channel frame, free of joints in faces. Reinforce top as required to support hanging from suspension components. Provide internal insulation and gasketed edge construction to achieve specified acoustical ratings.

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- 2. Panel Thickness: Nominal 3-inches.
 - 3. Panel Skin: Roll-formed steel wrapping around the panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction.
 - E. Hinges for Closure Panels, Pass Doors and Pocket Doors: SOSS Invisible laminated hinge with antifriction segments mounted between each heat treated link. Hinge shall be attached directly to panel frame. Welded internal hinge bracket shall support the hinge and allow for adjustment of hinge plates.
 - F. Panel Trim: No vertical trim on edges of panels; minimal groove appearance at panel joints.
 - G. Panel Weight: 8-pounds per sq. ft.
 - H. Panel Finish: Maharam "Flaxen 397130", 017 Eucalyptus color, 100-percent vinyl with polyester/cotton osnaburg backing, Type II, 20-ounce.
- 2.03 Sound Seals:
- A. Vertical Interlocking Sound Seals between Panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation.
 - B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
 - C. Horizontal Bottom Seals: Automatic operable seals providing nominal 2-inch operating clearance with an operating range of + 1/2-inch to – 1-1/2-inch which automatically drop as panels are positioned, without the need for tools or cranks.
- 2.04 Suspension System:
- A. Suspension Tracks: Minimum 7-gauge, 0.18-inch roll formed steel. Static loading of track with brackets at 48-inch centers shall show no failure of track or brackets at 5,000-pounds point loading at mid-span. Track shall be supported by adjustable steel hanger brackets connected to structural support pairs of 1/2-inch diameter threaded rods. Brackets shall support the load bearing surface of the track.
 - 1. Exposed Track Soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.
 - B. Carriers: Two all-steel trolleys with steel tired ball bearing wheels. Suspension system shall provide automatic indexing of panels into stack area using pre-programmed switches and trolleys without electrical, pneumatic, or mechanical activation.
- 2.05 Pocket Door: Full height at end of partition runs to conceal stacked partition, of same basic design, materials, thickness, and acoustical qualities as panels. Provide manufacturer's standard method to secure pocket door in closed position.

PART 3 - EXECUTION

- 3.01 Install folding panel partitions and accessories in compliance with ASTM E557 after other finishing operations, including painting, have been completed.
- 3.02 Lubricate bearings and sliding parts; adjust to ensure smooth, easy operation.

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- 3.03 Clean folding panel partition surfaces and adjacent surfaces soiled by work of this Section. Do not use abrasive cleaners or solutions containing corrosive solvents. Use cleaning materials recommended by the manufacturer.
- 3.04 Demonstrate proper operation and maintenance procedures to Owner's Representative.

END OF SECTION

SECTION 10800
TOILET ACCESSORIES

PART 1 - GENERAL

- 1.01 This Section describes the requirements for furnishing and installing toilet accessories.
- 1.02 Toilet tissue dispensers shall be continuous flow type. Dispensers that control delivery are not acceptable. Comply with California Building Code (CBC) Section 1115B.8.4.
- 1.03 Furnish manufacturer's written 5-year warranty against silver spoilage of mirrors, agreeing to replace any mirrors that develop visible defects within warranty period.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Bobrick Washroom Equipment, Inc., ASI or approved equal.
- 2.02 Materials:
 - A. Stainless Steel: AISI 18-8 Type 304, with No. 4 finish.
 - B. Mirror Glass: Clear tempered float glass with silvering, electro-plated copper coating, and protective coating.
 - C. Fasteners: Concealed screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed. Exposed face fasteners are not acceptable.
 - D. Keys: Unless otherwise directed by the Owner, provide universal keys for access to toilet accessory units requiring internal access for servicing. Provide a minimum of six keys.
- 2.03 Toilet Accessory Items: Manufacturer and model numbers as indicated on the Finish Legend.

PART 3 - EXECUTION

- 3.01 Check wall openings for correct dimensions, plumbness of blocking or frames, and other preparation that would affect installation of accessories. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.
- 3.02 Install toilet accessory units in accordance with manufacturer's instructions, using tamper-proof fasteners. Finish of exposed fasteners shall match accessory item secured. Install units plumb and level, firmly anchored in locations and at heights indicated.
- 3.03 Secure mirrors to walls in concealed, tamper-proof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.
- 3.04 Fit flanges of accessories snug to wall surfaces. Install sanitary sealant in gaps between 90-degree return flanges and finish wall surface after installation.
- 3.05 Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items. Clean and polish exposed surfaces of accessories in accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

SECTION 11030

TRANSACTION WINDOWS

PART 1 - GENERAL

- 1.01 This Section includes the following:
- A. Bullet-resistant transaction windows.
- 1.02 Bullet-resistant transaction windows shall have a non-ricochet type and non-pop out type frame which holds the glazing in place.
- 1.03 Warrant transaction windows to be free from defective materials and workmanship for a period of 2-years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 Bullet-Resistant Transaction Windows:
- A. Approved Manufacturer: Bullet Guard Corporation or approved equal.
 - B. Frame: Extruded aluminum, 6063 alloy with a minimum wall thickness of .125-inch, deep capture design with a minimum deep capture of 1-inch on all three sides of the window. Frames shall be extruded to allow fasteners to be applied to the threat side of the frame. Frames shall be pre-glazed at the factory.
 - C. Glazing: UL-listed materials complying with UL 752 Level III.
 - D. Deal Tray and Counter: 2-1/4-inch thick countertop the full width of the window lined with UL 752 ballistic fiberglass, the same level of protection as the glazing. Counter shall have a built-in stainless steel non-ricochet deal tray. Countertop material and finish as selected by the Architect from manufacturer's standards.
 - E. Voice Port: Windows shall have a natural voice port for sound transmission. Voice port shall be made of the same glazing material and shall overlap the gap in the glazing a minimum of 2-inches.

PART 3 - EXECUTION

- 3.01 Install transaction windows in compliance with manufacturer's specifications and recommendations for installation of windows, hardware, operators, and other components.
- 3.02 Set units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
- 3.03 Adjust operating sash and hardware to provide for smooth operation.

END OF SECTION

SECTION 11132
PROJECTION SCREENS

PART 1 - GENERAL

- 1.01 This Section includes electrically operated, ceiling recessed, front projection screens, projector mounts and fittings, mounting brackets, anchorages, and accessories.
- 1.02 Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

- 2.01 Front Projection Screens, Electrically Operated:
 - A. Approved Manufacturers: Draper, Inc. "Access/Series V" or approved equal.
 - B. Screen Case: Metal-lined motor compartment, with hinged or removable access panel to motor compartment, electrical outlet box, and finished with manufacturer's standard prime coat. Bottom closure panel forms slot for passage of viewing surface and is removable for access to operating mechanism.
 - C. Motor Unit: Mounted inside roller, size and capacity recommended by the screen manufacturer, with preset adjustable limit switches to automatically stop screen in "up" and "down" position. Provide a 3-button remote control switch with cover plate for flush wall-mounting.
 - D. Screen Fabric: Matte white, washable surface, M1300.
 - E. Screen shall be provided with a dual remote control 3-button switch and low voltage control interface.
 - F. Screen shall be provided with a masking border.
 - G. Screen Sizes: As indicated.
- 2.02 Projectors: Furnished by the Owner.
- 2.03 Projector Mounts: Ergo "PBL Series" or approved equal. Coordinate model number with projector furnished by the Owner. Provide projector mount manufacturer's concealed T-bar frame adapter for mounting to suspended ceiling frame.

PART 3 - EXECUTION

- 3.01 Install projection screens, projector mounts and accessories in accordance with manufacturer's instructions.
- 3.02 Install projection screens with screen cases securely anchored to supporting substrate in compliance with CBC seismic requirements, in a manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when lowered.
- 3.03 Test units to verify that screen, controls, limit switches, closure and other operating components are functioning properly.
- 3.04 Protect projection screens after installation from damage. If damage occurs, remove and replace or restore to original undamaged condition.

END OF SECTION

SECTION 11452

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

- 1.01 This Section includes residential appliances.
- 1.02 Accessibility: Conform to the more restrictive provisions of Title III of the American with Disabilities Act or the California Building Code (CBC).
 - A. Appliances required to be accessible shall conform to all reach requirements per CBC Figure 11B-16 and 11B-17.

PART 2 - PRODUCTS

- 2.01 Residential Appliances: Manufacturer and model numbers as indicated on the Finish Legend.

PART 3 - EXECUTION

- 3.01 Install appliances in accordance with manufacturer's instructions and recommendations.
- 3.02 Securely anchor built-in appliances to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper operation and rough openings are completely concealed.
- 3.03 Test each appliance to verify proper operation. Make necessary adjustments.
- 3.04 Remove packing material from appliances and leave in clean condition, ready for operation.

END OF SECTION

SECTION 12211

HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 This Section includes horizontal aluminum blinds at the following locations:

- A. Exterior glass.
- B. Interior glass at demountable partitions and doors with glazing.

PART 2 - PRODUCTS

- 2.01 Approved Manufacturers: Mariak Contract or approved equal.
- 2.02 Slats: Unperforated slats, nominal 1-inch wide x 6-gauge aluminum.
- 2.03 Tilt Operation: Full tilt, manual with wand. Position as directed by the Architect.
- 2.04 Cord Lock Operation: Cord lock, locks pull cord to stop blind at any position in ascending or descending travel. Position as directed by the Architect.
- 2.05 Cord Equalizers: Self-aligning to maintain horizontal blind position.
- 2.06 Valance: Match color of slats.
- 2.07 Color: As selected by the Architect from manufacturer's full range of colors.
- 2.08 Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:
 - A. Blind Units Installed Between Jambs: Width and length equal to 1/2-inch less than opening dimensions formed by jamb, head, and sill members of opening in which each blind is installed.
 - B. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- 2.09 Installation Fasteners: Not less than two fasteners per bracket, fabricated from metal non-corrosive to blind hardware and adjoining construction and to support blind units under conditions of normal use.

PART 3 - EXECUTION

- 3.01 Install blinds level, plumb, and located so that slat edges in any position are not closer than 1-inch to interior face of glass lites, gaps between slat ends and jambs do not exceed 1/4-inch plus or minus 1/8-inch, and bottom rail in fully lowered position is within 1/2-inch of bottom of window or other opening.
- 3.02 After completing the installation, clean blind surfaces according to the manufacturer's instructions.

END OF SECTION

SECTION 15050

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL REQUIREMENTS

1.01 GENERAL CONDITIONS:

The general conditions and Division 1 are a part of this section and the contract for this work and apply to this section as fully as if repeated herein. This section, 15050, applies to all Division 15 categories, including but not limited to:

Section	15400	Plumbing
	15800	Heating, Ventilating and Air Conditioning

- A. Reference to Other Sections: The applicable requirements from the above sections shall form a part of the mechanical work and each section shall consult the other sections in detail for general and specific requirements.

1.02 SCOPE:

These Division 15 specifications and the accompanying drawings are intended to comprise the furnishing of all labor, and the furnishing and installing of all materials, equipment and supplies as specified herein and required for the satisfactory completion by the Contractor of all work pertaining to mechanical trades.

1.03 EXPLANATION OF DRAWINGS AND REFERENCE TO SCHEDULES:

- A. The drawings and these specifications are complementary to each other in that all apparatus, materials and equipment outlined in the drawings and/or specified herein shall be considered essential to the contract.
- B. The specifications are intended to describe the quality and character of the materials and equipment and methods of installation. All miscellaneous items of work and materials necessary for the completion of the installation shall be provided, whether or not mentioned in the specifications or shown on the drawings.
- C. Space allotted, clearances, access, electrical data, structural supports, etc., on drawings, is for equipment models and sizes as listed in schedules on plans. The Contractor shall assume the responsibility for the coordination with other trades required in the use of equal or substitute equipment or materials and pay all difference in cost arising from such substitutions, regardless of approval.
- D. Separate Sections cover the Site Work, Architectural Work and the Electrical Work. The Contractor shall familiarize themselves with the entire specification.
- E. Should there be any question as to the scope of the work for which the Contractor is responsible, they shall ask the Architect for an interpretation before submitting their bid. In the event that the Contractor finds discrepancies or omissions, or is in doubt as to the exact meaning of the plans and/or specifications, they shall, before submitting bid, contact the Mechanical Engineer for clarification.

- F. For purposes of cleanness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, the Contractor shall make use of all data in all the contract documents and shall verify this information at building site.
- G. The drawings indicate required size and points of termination of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of the Contractor to make the installation in such a manner as to conform to structure, avoid obstruction, preserve headroom and keep openings and passageways clear.
- H. It is intended that all apparatus be located symmetrical with architectural elements. Refer to architectural details in completing the correlating work.
- I. The Contractor shall fully inform themselves regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract. They shall exercise due and particular caution to determine that all parts of their work are made quickly and easily accessible.
- J. The Contractor shall study all drawings and specifications to determine any conflict with ordinances and statutes. Any errors or omissions shall be reported, and any changes shall be shown in the as-built drawings and the additional work performed at no cost to the Owner.
- K. The submittal of bid shall indicate that the Contractor has examined the site and the drawings and has included all required allowances in their bid. They shall also determine in advance and make allowances for the methods of installing and connecting the equipment, the means of getting equipment in to place and they shall make themselves familiar with all the requirements of the contract. No allowance will be made for any error resulting from the Contractor's failure to visit job site and to review drawings, and bid shall include costs for all required drawings and changes as outlined above.
- L. The Contract Drawings indicate the extent, the general location and arrangement of equipment, piping, ductwork, etc. Equipment, piping and ductwork shall be located to avoid interference with electrical, plumbing and structural features. All locations for mechanical work shall be checked and coordinated with the building, structural, electrical work.
- M. If any conflicts occur necessitating departures from the Contract Drawings, details of departures and reasons therefore shall be submitted as soon as practical for written approval, and the piping, ductwork, fixtures or equipment affected shall not be installed until approval is received.
- N. Reference to Drawing Schedules:
 - 1. Refer to equipment schedule for unit identification number and corresponding capacity and design requirements.
 - 2. Wherever schedules or notes appear on the Drawings or in the specifications in which sizes and capacities of equipment are indicated, the equipment furnished and installed under this contract shall meet the following requirements under operating conditions:

1.04 DEFINITIONS:

- A. "Provide" shall mean "provide complete in place," that is, "furnish and install."
- B. "Piping" shall mean pipes, fittings, valves and all like pipe accessories connected thereto.
- C. Pressure ratings specified, such as for valves and the like, is the design working pressure and is for and with reference to the fluid which the device will serve.

- D. "Ductwork" shall mean ducts, plenums, compartments, casings or any like devices, including the building structure, which is used to convey or contain air.
- E. "Building Boundary" shall mean exterior building walls.
- F. "Mechanical Work" shall mean all work specified and shown in the Division 15, "Mechanical," categories. Mechanical Work generally includes: Plumbing, Heating, Ventilating, Air Conditioning and Fire Protection systems.

1.05 CODES AND STANDARDS:

- A. All work, material or equipment shall comply with the requirements of codes, ordinances and regulations of the local Government having jurisdiction at the location of the work, including the regulations of serving utilities, and any participating Government agencies having jurisdiction.
- B. The latest editions of the following Specifications, Codes and Standards shall form a part of these specifications, the same as if herein written out in full, and all materials and installations include but not be limited to:
 - 1. CMC (California Mechanical Code)
 - 2. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning)
 - 3. UL (Underwriters' Laboratories, Inc.)
 - 4. AMCA (Air Moving and Conditioning Associates)
 - 5. California State Division of Industrial Safety
 - 6. SMACNA HVAC Duct Construction Standards
 - 7. CBC (California Building Code)
 - 8. NFPA (National Fire Protection Association)
 - 9. San Diego County Codes
 - 10. California Administrative Code, Title 24
 - 11. Requirements of the State Fire Marshall
 - 12. National Electrical Code
 - 13. ASTM (American Society for Testing and Materials)
 - 14. AGA (American Gas Association)
 - 15. OSHA
 - 16. CPC (California Plumbing Code)
- C. No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. No apparatus, equipment, device or construction shall be installed which will provide a cross connection permitting any backflow or siphonage from any source into the domestic water supply system.

1.06 PERMITS AND FEES:

Obtain all permits, patent rights, and licenses that are required for the performing of the work by all laws, ordinances, rules and regulations, or orders of any officer and/or body, give all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdictional authority and the Architect.

1.07 SUPERVISION AND COOPERATION:

- A. The Contractor shall include the services of experienced superintendents for each sub-section who shall be constantly in charge of the work, together with the qualified journeymen, helpers, and laborers, required to properly unload, install, connect, adjust, start, operate and test the work involved, including equipment and materials furnished by others.
- B. The work under this section shall be in cooperation with the work of other trades to prevent conflict or interference and to aid rapid completion of the overall project.

1.08 PROJECT SITE VISIT:

Periodic visits to the project site by the Engineer are for the expressed purpose of verifying compliance with the contract documents. Such site visits shall not be construed as construction supervision, i.e., the Engineer assumes no responsibility for providing a safe place for the performance of the work by the Contractor or the Contractor's employees or the safety of the supplies of the Contractor. Neither shall such site visits relieve the Contractor of the responsibility for the discovery of their own errors and the correction of them, nor of the responsibility of properly performing the work.

1.09 COORDINATION:

- A. The Contractor shall be responsible for providing all information, drawings or layouts of equipment or work under this section which affect the work of the other trades.
- B. In case changes in the indicated locations or arrangements are necessary due to developed conditions in the construction, or rearrangement of furnishings, or equipment, these changes shall be made without extra cost to the Owner, provided the change is ordered before work directly connected is installed, and no extra materials are required.

1.10 EXISTING UTILITIES:

- A. The location of utilities shown on the plumbing plans is the best known information available at time of design. The Contractor shall contact the appropriate agencies and confirm the information and make arrangements for connection thereto, prior to excavation and installation of any piping or systems.
- B. Prior to installation of any waste and soil lines the Contractor shall physically verify whether the building sewer can be installed and properly connected to the sewer main. Any work requiring added expense which is caused by the Contractor to make such physical verification shall be borne by the Contractor.

1.11 UTILITY SERVICES DURING CONSTRUCTION:

All water and electric power used for construction shall be paid for by the Contractor.

1.12 SUBMITTALS AND SHOP DRAWINGS:

- A. Equipment and materials shall be submitted to the Architect for approval within 30 days after award of Contract and prior to fabrication or purchase of equipment and materials.
- B. Installation of materials or ordering of equipment prior to approval of submittals is done entirely at the risk of the Contractor.
- C. Unless otherwise specifically directed in the following specifications, the submittals by the Contractor to the Architect shall be as follows:
 - 1. Submit all items at one time in a neat and orderly manner with index tabs. A partial submittal will not be acceptable.
 - 2. Reference catalog cuts and brochures of products to proper paragraph in specifications. Furnish numerical index by specification article number, listing product name, catalog number and reference to page number of submittal brochure.
 - 3. Cross reference individual catalog numbers of substitute products to number of specified materials.
 - 4. Bind submittal in booklet form.
 - 5. Submit manufacturers' certification that equipment meets or exceeds the minimum requirements as specified.
 - 6. Where materials, equipment and installations are specified to conform with societies or agencies such as ANSI, ASHRAE, SMACNA, etc., submit certification of such compliance.
 - 7. The submittal shall be complete and with catalog data and information properly marked to show, among other things, material capacity and performance to meet capacities or performance as specified or indicated. Arrange the submittals in the same sequence as the specifications and reference in the upper right-hand corner, the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected, unless prior approval for partial submittal has been obtained.
 - 8. The Contractor is responsible for confirmation of code approval of material and equipment. Certification of code conformance by the manufacturer shall be submitted for:
 - a. Water heaters.
 - b. Backflow preventors.
 - 9. If the Contractor submits a product that is specified, a complete set of brochures, rating tables, etc., is still required for future reference.
 - 10. Review of the submittal is only for general conformance with design concept of project and general compliance with information given in the contract documents. The Contractor is responsible for confirmation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all trades. Deviations from drawings and specifications shall be clearly and completely indicated (by a separate letter) in the submittal.

11. For items which are not manufactured and which have to be specifically fabricated including drawings and typical duct construction and complicated portions of ductwork, six copies of shop drawings and detail description shall be submitted. Shop drawings shall be submitted with such promptness as to allow ample time for examination and any re-submittal.

- D. For duct and piping shop drawing development, the contractor shall obtain the most current architectural, structural and electrical CAD files to be overlaid on to mechanical duct and piping shop drawings.

1.13 SUBSTITUTIONS:

- A. Substitution of an article, device, product, material, fixture, form or type of construction, other than those specified by name, make or catalog number is not permitted before the bid date. The contractor awarded the project, may propose substitutions as part of the submittal package as value engineering items. Written approval cannot be finalized until submittals are examined and credit to the owner is established.
- B. If the use of substituted equipment results in an increase in the cost, including the work of other trades, the Contractor shall be solely responsible for payment of said increase in cost.

1.14 GUARANTEE:

- A. In addition to the guarantees required elsewhere, all work, materials and equipment provided under the mechanical sections shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall immediately furnish all necessary labor and materials to correct the trouble without cost to the Owner. The Contractor, under this guarantee, shall be responsible for all damages to any part of the premises caused by equipment furnished under this section.
- B. Furnish written certified guarantee, in acceptable form, to the Owner, against defective workmanship, materials and operating equipment. Further guarantee to rebalance and adjust entire system, or any part thereof as required for perfect operation for a period of at least one year after acceptance. Compressors shall have five year warranty. Repair, replace and make satisfactorily operative any and all defective items and work, holding the Owner free from any cost and liability in connection therewith, for the term of the guarantee.

1.15 INTERRUPTION OF SERVICES:

- A. Existing services required to stay in operation in areas not remodeled shall be maintained rerouted or otherwise provided with temporary connection to prevent interruptions.
- B. If impossible to prevent interruptions they shall be performed during "off-hours" and coordinated with the Owner's Representative.
- C. Provide a minimum of seven (7) days written notice of interruption. Do not interrupt services without written consent of the Owner.

1.16 DAMAGE BY LEAKS:

The Contractor shall be responsible for damage to the grounds, walks, roads, buildings, furnishings, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping systems being installed or having been installed herein. They shall repair at their expense all damage so caused.

1.17 EMERGENCY REPAIRS:

The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibilities.

1.18 DEMOLITION:

A. Demolition, capping and rerouting shall be performed as shown and as required to accommodate new construction.

PART 2 – PRODUCTS

The specification of the mechanical products is detailed in the individual specification sections of Division 15.

PART 3 – EXECUTION

3.01 INSTALLATION INSTRUCTIONS:

A. The requirements of "mechanical" installation is detailed in the individual specification sections of Division 15. In addition the following general requirements shall apply:

1. Obtain Manufacturer's printed installation instruction to aid in properly executing work of installing equipment whenever such instructions are available. Submit three copies of such instructions to the Architect prior to time of installation for use of supervising the work.
2. Erect equipment in a neat and workmanlike manner. Align, level and adjust for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from arrangements shown on drawings may be made, as approved by the Architect.

3.02 PROTECTION OF PIPING SYSTEMS:

- A. It shall be the responsibility of the Contractor to install and maintain pipe and equipment which is reasonably clean and free from rust, dirt, scale, etc. Where necessary, the Contractor shall provide temporary airtight covers at all pipe and equipment openings.
- B. Before turning the systems over to the Owner, all piping systems shall be thoroughly flushed of all scale and dirt. Drains shall be installed at the low points to facilitate flushing of the piping systems.

3.03 PROTECTION OF AIR HANDLING SYSTEMS:

- A. The Contractor shall continuously maintain adequate protection to keep dirt and foreign matter from getting into the air handling system.
- B. Ductwork shall not be left open for any extended period of time. Open section and open fittings shall be capped wherever they occur until such time as final connections are made to equipment, grilles, register, etc.

3.04 PROTECTION OF ELECTRICAL SYSTEMS:

Do not route liquid filled pressure and drain piping over electrical equipment, switchboards motor control centers and the like. When unavoidable, install galvanized drain pans to prevent liquid from dripping or squirting onto such equipment.

3.05 RECORD DRAWINGS:

- A. The Contractor shall keep an accurate dimensional record of the as-built locations of all work under this Contract. This record shall be kept up-to-date at all times on blue line prints as the job progresses, and shall be available for inspection at all times.
- B. Upon completion of the work, obtain from the Architect one complete set of reproducible prints of the applicable Contract Documents. Record all changes and information contained on the Record Drawings onto the new set of reproducible prints in an orderly and legible manner.
- C. Submit two blue line prints of the completed reproducible Record Set for approval. Make such changes and correction as may be required for final approval.
- D. When final approval is received, sign the reproducible Record Set and stamp or note "As-Built" and submit to the Architect.
- E. Final observation will not be made until these approved as-built drawings have been received by the Architect.

3.06 CUTTING AND PATCHING:

- A. Perform all cutting and fitting required for work of this Section in rough construction of the building.
- B. All patching of finished construction of building shall be performed under the section of specification covering these materials.
- C. All cutting of concrete work by this Contractor shall be by core drilling or concrete sawing. No cutting or coring shall be done without first obtaining the permission of the Architect.
- D. Information regarding requirements for openings, recesses, chases in the walls, partitions, framing or openings shall be provided for work under the appropriate sections of the specifications in advance of the work. Should this be neglected, delayed or incorrect and additional cutting is found to be required, this work shall be accomplished at no additional cost to the Owner.
- E. All access panels shall be approved by the Architect as to location, appearance, and finish.

3.07 VIBRATION ELIMINATION AND CONNECTORS:

Rotating or reciprocating mechanical equipment shall be mounted on or suspended from vibration isolators to prevent vibration and structural borne noise transmission to the building. Refer to each mechanical trade section of these specifications for specific details. Flexible duct connection shall be used between all fan openings and sheet metal work. Flexible connectors shall be used in piping connections to rotating or reciprocating equipment. See individual mechanical sections for specifications.

3.08 REQUIREMENTS FOR FINAL INSPECTION:

- A. All of the following items must be completed prior to final inspections. No exception and no final payment will be made until all items are completed and approved. For specific requirements see the individual section in the Division 15 Category.
 - 1. Cleaning equipment and premises
 - 2. Test and balance of systems

3. Test and balance reports are reviewed by the Engineer
4. Service manual
5. Pipe and valve identification
6. Pipe and valve identification schedule
7. Operation tests
8. Operating instructions
9. As-built drawings
10. Certification of water sterilization

3.09 EARTHQUAKE RESTRAINT:

- A. General:
- B. All earthquake resistant designs for mechanical equipment, such as air handling units, water heaters, blowers, motors, ductwork, mechanical and plumbing piping, shall conform to the regulations of the California Building Code, Chapter 16, Sec. 1626 to 1632 "Earthquake Design" and Table 16 of that code.
- C. The restraints which are used to prevent disruption of the function of the piece of equipment because of the application of the horizontal force shall be such that the forces are carried to the frame of the structure in such a way that the frame will not be deflected when the apparatus is attached to a mounting base and equipment pad, or to the structure in the normal way, utilizing the attachments provided. Equipment, piping, ductwork, etc. shall be secured to withstand a force in any direction equal to the value shown in Table 16.
- D. Piping:
 1. All HVAC and Plumbing piping shall be secured by bracing at every fourth hanger transversely and every eighth hanger longitudinally. Bracing shall be done in accordance with the NFPA Code, and as described in paragraph "Sway Bracing for Protection Against Earthquakes," of that code.
 2. As approved by code authority, the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems" may be used as a guide.
- E. No sway bracing is required for pipes that are installed on very short hangers (12-inches or less).
- F. As approved by the code authority a bracing system as manufactured by "Superstrut" or "Pipe Shields Inc." may be used.

3.10 ADJUSTMENTS OF SYSTEMS AND OPERATION TESTS:

- A. When the work included in these specifications is complete, and at such time as directed by the Architect, the Contractor shall adjust all parts of the systems, advising the Architect when this has been done and the work is ready for their final tests. Refer to "Balancing and Testing Procedures" in Section 15800.

B. The Owner may require operation of parts or all of the systems prior to final acceptance. If it becomes necessary for temporary use of the systems before all parts are complete, the Contractor shall adjust all parts as far as possible in order to make such temporary use as effective as possible. After temporary use and before acceptance tests, all systems shall be readjusted to meet permanent operational requirements. This occupancy shall not be construed as final acceptance cost of utilities for such operation will be paid by the Owner.

C. Operation Test:

1. At completion, the Contractor shall operate all mechanical systems for a period of at least three eight-hour days to demonstrate fulfillment of the requirements of the contract. During this time all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Architect and the Owner.
2. Final Operation and Instruction: Upon completion of the installation of the equipment and after final acceptance, at a time approved by the Owner, the Contractor shall place a competent person at the building who shall operate the systems for a period of three eight-hour days instructing the Owner's Representatives in all details of operation and maintenance.
3. Any required instructions from manufacturer's representatives shall be given during this period. The three days specified under "Operation Test" does not substitute for these days of final operation and instruction.
4. All arrangements for operation periods shall be made through the Owner, and the Architect.

D. For specific requirements see individual Mechanical Sections.

3.11 RUBBISH REMOVAL AND CLEANING:

Upon completion of the work under this section, the Contractor shall remove all surplus materials, equipment and debris incidental to their work, and leave the premises clean and orderly.

3.12 SERVICE:

Ninety (90) days free service shall be provided after completion of the job including changing of filters. Replacement filters shall be provided by the Owner and shall be on the job site.

3.13 PAINTING:

- A. Excepting piping identification specified in the specific section all painting is specified in the Painting Section of the Specifications.
- B. Surfaces to be painted shall be cleaned of cement, plaster and other spills.
- C. Factory finishes shall be repaired to original condition when scratched or dented.

END OF SECTION

SECTION 15400
PLUMBING

PART 1 - GENERAL

1.01 SUMMARY:

- A. The "Mechanical General Provisions," Section 15050 is a part of this section and applies as fully as if repeated herein.
- B. The work under this section includes everything necessary for and incidental to executing and completing the plumbing work, except as hereinafter specifically excluded. All work shall include up to 5 feet outside of the building unless noted otherwise on the drawings.
- C. Work included shall be as indicated on the drawings, including but not limited to the following:
 - 1. Sanitary Soil, Waste and Vent Piping for Fixture Connections to the Existing Systems
 - 2. Domestic Water Piping including Water Heater for Fixture Connections to the Existing Building Water Service
 - 3. Plumbing Fixtures and Equipment
 - 4. Condensate Drain System for HVAC Equipment
 - 5. Sterilization and Tests
 - 6. Fixture Connections
- D. Work not included:
 - 1. Not included as part of the work of this section are the following items:
 - a. Cutting and blocking of structure for fixtures and piping.
 - b. Forming and pouring of concrete for housekeeping pads

1.02 GENERAL REQUIREMENTS:

- A. Reference to Other Sections: The applicable requirements from the following specification sections shall form a part of the plumbing work and the Contractor shall consult them in detail for general and specific requirements
- | | | |
|---------|-------|---|
| Section | 15050 | Mechanical General Provisions |
| | 15800 | Heating, Ventilating and Air Conditioning |

PART 2 – PRODUCTS

2.01 INSULATION:

- A. Domestic hot water piping and 8 feet of cold water pipe at the water heating equipment shall be insulated with JM "Micro-Lok" Fiberglass, or equal with pressure sensitive closure system jacket. The conductivity range of the insulation shall be 0.24-0.28 BTU-IN/HR-SF-°F with a mean temperature rating of 100°F.
- B. See table below for thickness of insulation:

Runouts	½" to 2"	2½" +
½"	1"	1½"

Insulation is equal to Johnson-Manville, Certain-Teed Fiberglass.

- C. Fittings shall be insulated with Manville Products #301 cement to a thickness equal to the adjoining pipe insulation and finished with 4-oz. canvas pasted on or finished with "Zeston" premolded PVC insulated fittings.
- D. Where piping is exposed to view, factory-applied 6-oz. canvas jacket or PVC jacketed shall be installed.
- E. The insulation shall be applied over clean, dry pipe with all joints butted firmly together. The factory-attached tape shall be pasted smoothly over the insulation.
- F. Toilet room fixture traps, drains, and hot water supply to wall of fixtures accessible to the handicapped shall be insulated with Handy Shield safety covers by Plumberex Specialty Products, Truebro Lav-Guard, or equal.
- G. Condensate, condensate overflow piping, and sewer piping above grade, within building receiving cold condensate shall be insulated with JM Rubatex.

2.02 FITTINGS AND PIPING:

A. Soil, Waste, and Vent Within the Building:

1. Above Grade:

- a. Cast iron "no-hub" conforming to CISPI 301 with neoprene gasket and Type 301 stainless steel clamping device conforming to CISPI 310.
- b. At space limitations and waste pipe over watertight areas, use DWV copper drainage tubing with cast brass fittings.

B. Domestic Water Piping:

1. Above Grade: Type L copper tubing hard drawn:

- a. Wrought copper solder sweat fittings and lead-free solder.

C. Condensate Piping: Type "M" copper tubing, hard drawn with wrought copper or cast brass fittings, and 50-50 solder joints.

2.03 PIPING SPECIALTIES:

A. Lead-Free Unions:

1. In copper tubing 3" and smaller, Nibco633LF/733LF, or equal.

B. Lead-Free Isolation Unions: Watts, Epco model Fx; Isolation flanges, Epco model GX; Isolation waterways.

C. Water hammer arresters in accordance with PDI-WH-201 standards, Zurn Z1700 Series, Josam 75000 Series, JR Smith 5000 Series PPP or equal. Install with access panel.

D. Gas Flexible Connector: Brass Craft one piece construction, uncoated Type 304 stainless steel, cadmium-plated steel flare nuts, and fittings.

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- E. Fixture Supplies: Flexible stainless steel braided, compression fittings equal to Sanitary Dash, Speedway, or Brasscraft.
- F. Strainers 2" and Smaller: 250 lb., W.W.P., cast bronze, screwed, "Y" Pattern, 20 mesh, S.S. screen; Keckley F150, Wilkins YSBR100 Series, Watts, Armstrong or equal.
- G. Strainers 2-½" and Larger: 150 lb., cast bronze, flanged, "Y" pattern, S.S. screen, Armstrong F4FL, Keckley Style A, or equal. Install plugged gate valve of same size as strainer plug.
- H. Escutcheons: 1" wide chrome or nickel-plated rust resistant.

2.04 VALVES:

A. Water:

- 1. Lead-Free Ball Valves: Sizes ½" through 2 ½" NibcoS68580LF/T68580CF or equal.
- 2. Check Valves:
 - a. Swing, 2-½" and smaller: Class 125, bronze, Y-Pattern, horizontal swing, renewable disc, threaded or solder; NibcoT413YLF/S413YLF series or equal.
- 3. Stops: Angle or straight valve loose key with escutcheon at wall penetration. Stop and escutcheon shall be chrome plated Brasscraft, or equal.
- 4. Mixing Valve: Undercounter mixing valve for lavatory faucets, thermostatic tempering, one valve to serve one to four faucets equal to Powers e490 series, Leonard, or Symmons.

2.05 CLEANOUTS:

- A. Cleanouts shall be manufactured by Zurn, J.R. Smith, Josam or equal.
- B. Wall Cleanouts: Zurn Z-1446, J.R. Smith Fig. 4532, or equal with stainless steel or chrome plated cover and screws.

2.06 FLASHINGS:

- A. "Stoneman" No. 1100-4 or equal, four pound, seamless lead flashing assembly. Flashing shall have reinforced boot complete with cast-iron counterflashing sleeve and Permaseal waterproofing compound. All vent pipes shall be terminated 12" above the roof. (Roof penetrations per roofing inspector standards.)

2.07 HANGERS, SUPPORTS AND ACCESS PANELS:

- A. Hangers and supports shall comply with the currently adopted edition of the California Plumbing Code and the IAPMO installation standards. Provide seismic support per the California Building Code.
- B. Hangers and Supports:
 - 1. Split Ring or Loop Hangers with Swivel Adjuster, Solid Rods and Rod Sockets: B-line, Unistrut, Tolco, or PHD.
 - 2. Concrete Inserts: B-line, Unistrut, Tolco, or PHD. Power driven anchors are not acceptable.
 - 3. Riser Clamps: B-line, Unistrut, Tolco, or PHD.

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4. Offset Pipe Clamps: B-line, Unistrut, Tolco, or PHD.
 5. Cold Water Pipe Isolation: 1-inch hair felt, Stoneman Trisolators or B-line, Isolators
 - C. Access Panel for Valves and Water Hammer Arresters: Milcor, Elmdor, Karp, or equal painted steel, size as required for easy access, fire rated as required to match fire rating of wall assembly. Minimum size shall be 12" x 12".
 - D. For vertical mid-span supports of piping 4" and under, use Hubbard Enterprises/HOLDRITE Stout Brackets™ with Hubbard Enterprises/HOLDRITE Stout Clamps or two-hole pipe clamps (MSS Type 26).
 - E. Secondary Pipe Positioning & Supports: Makeshift, field devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with APMO PS 42-96. These shall be Hubbard Enterprises/HOLDRITE support systems or Owner-approved equivalent.
 - F. Plenum Installations: Use pipe supports that meet ASTM E-84 25/50 standards, such as the Hubbard Enterprises/HOLDRITE Flame Fighter™ or Owner-approved equivalent.
 - G. Fixture Supports: Furnish wall hung fixtures with supports by Zurn or J.R. Smith.
 1. Water Closets: Zurn, Z-1204-IN, J.R. Smith 200 series
 2. Lavatories: Zurn, Z-1231-SL, J.R. Smith 700
- 2.08 PLUMBING EQUIPMENT:
- A. The equipment described in Part 2 of this Section shall be furnished and installed complete under this section of the specifications. See "Equipment Schedule" on drawings for size, capacity, and electrical characteristics.
 - B. Water heaters shall be listed in the State of California Energy Commission Directory of Certified Water Heaters.
 - C. Suspended Water Heaters and Similar Equipment: When water heaters and similar equipment are installed in a suspended application, an engineered and manufactured platform, such as the Hubbard Enterprises/HOLDRITE Suspended Water Heater Platform shall be used. Weight loading capability shall include a minimum safety factor of 2.
- 2.09 PLUMBING FIXTURES:
- A. General Requirements:
 1. All fixtures shall comply with State of California Energy Commission requirement for maximum flow. Submit manufacturer's certification of compliance.
 2. Unless otherwise noted, all vitreous china or enameled cast-iron fixtures and toilet seats shall be white.
 - B. P-Traps, chrome plated drawn brass with 17 gauge tubing drain to wall. Trap arms under lavatories and escutcheon at wall shall also be chrome plated.
 - C. Job Conditions:
 1. Check millworks shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2. Plumbing fixture trim and exposed supplies and waste shall be brass with polished chrome plated finish. Individual angle stops, or, if so specified, screwdriver stops, shall be provided for all supplies, and unless integral with valves or faucets, unless otherwise approved by Architect, shall be mounted under the fixture. Exposed supplies and wastes to wall shall be provided with polished chrome plated wall escutcheons.
3. Fixtures with hangers or supporting arms shall have hangers or arms securely mounted on a ¼" thick x 6" wide steel wall plate, which shall extend at least one stud beyond the first and last fixture mounting points. Concealed arm assemblies shall be attached to plates by four 3/8" x 1-¼" steel bolts and nuts, and hangers and exposed arms by 5/16" minimum full thread steel studs and jamb nuts. Plates shall be drilled and tapped at the time of fixture installation. Where light weight steel studs are used, fixture supports shall have manufactured floor mounted legs for attachment of supporting arms.
4. Supplies shall be with stops and flexible riser.
5. Traps above floor shall be tubular brass "P" traps with bronze nuts unless otherwise indicated.

2.10 PLUMBING EQUIPMENT SPECIFICATION SCHEDULE:

- A. See Water Heater Schedule on Sheet P0.1.

2.11 PLUMBING FIXTURE SPECIFICATION SCHEDULE:

- A. See Fixture Connection Schedule on Sheet P0.1.

2.12 OTHER PRODUCTS:

- A. Provide all other products necessary for complete installation and operation including rough-ins as required for washers and dryers. Such products shall be subject to the review of the Architect.

PART 3 – EXECUTION

3.01 INSULATION INSTALLATION:

- A. Install insulation after piping has been installed, tested, and accepted and after pipes are in a clean, dry condition. All joints in insulation shall be butted firmly together and sealed with jacket lap strip.
- B. Apply insulation to all fittings and valve bodies. Flanges and unions shall not be covered.
- C. Where the insulation supports the weight of the pipe, install a 12" insert of rigid galvanized steel, at each pipe clamp or hanger, an insert of rigid "Kaylo" 12" long, shall be installed between pipe and hanger. High density fiberglass inserts shall be installed with galvanized saddles.

3.02 PIPE INSTALLATION:

- A. No-Hub Cast-Iron Soil Pipe Institute Handbook (Chapter 4) and the IAPMO IS-6.
- B. Joints in copper tubing shall be made by first thoroughly cleaning the surface of the pipe and fittings, applying a copperized flux and sweating with 95-5 tin antimony solder for all water piping and condensate piping above grade and below grade.

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- C. All pipe shall be carefully cleaned before installation. The ends of threaded steel pipe shall be reamed out full size with a long tapered reamer so as to be partially bell-mouthed and perfectly smooth. Openings in pipes, drains, fitting apparatus and equipment shall be kept covered or plugged to prevent foreign substance from entering.
- D. The grade of all sanitary sewers and waste lines shall be as indicated on drawings. Sections of pipe shall be installed so as to provide smooth and uniform invert. Constant inspection shall be made of pipe and fittings during and after all installation for possible fractures and failures caused by installation.
- E. Flush out all water mains, sanitary and condensate drains with water so as to obtain free flow. Remove all obstructions and defects discovered. Remove and replace pipe already installed and found to be defective or which has had grade or joints disturbed at no additional cost.
- F. Run piping free of traps, sags, or bends. Grade and valve for complete drainage and control of the system.
- G. All piping shall be installed to maintain headroom and keep passageways and openings clear. Install piping parallel and straight with adjacent walls or ceilings to present a uniform appearance. All piping, except where noted otherwise on plans, shall be concealed in walls or above ceilings. Route piping to avoid electrical rooms. Do not route waste piping above kitchen areas. Do not route plastic pipe in return air plenums unless it is plenum-rated with a flame spread index of 25 or less and a smoke developed index of 50 or less.
- H. Bending or forcing of pipe will not be allowed. Use fittings for all offsets or changes in alignment of piping.
- I. Proper provision shall be made for expansion and contraction by means of fittings and anchors and supports of all piping.
- J. Bushings and long screw fittings will not be allowed.
- K. Install water hammer arresters at all flush valves and quick closing valves per PDI-WH-201 standards. The completed system shall be free of water hammer noise.
- L. Unions shall be installed after each screw-type valve, connections for all equipment, appliances, and as required for erection and maintenance. No unions shall be installed in concealed locations. Unions are not required on installations using grooved joint couplings. Install isolation unions or waterway fittings on all connections between dissimilar metals - (galvanized steel, black steel, cast iron to copper).
- M. No holes for pipe or equipment will be allowed in any structural members without written consent of the Architect. Where pipes are to pass through or interfere with any member, or where notching, boring or cutting of the structure is necessary, the work shall be done by the General Contractor as directed. Isolate pipe from coming in direct contact with the structure.
- N. Unless otherwise specified herein, all equipment and fixtures shall be installed in accordance with the manufacturer's printed recommendations.
- O. Any minor changes in work, which has not been installed, shall be made by the Contractor without additional compensation, except changes which are caused by architectural revisions resulting in an increase or decrease of the size or quantity of the materials specified or indicated on the drawings. The Contractor shall submit an estimate of the cost of or credit for such changes which are not judged to be of a minor nature and shall proceed only upon the written authorization of the Architect.

- P. All piping shall be isolated from other piping, studs, ducts, any part of the building, framing, hangers, conduit, etc., with 1" strips of hair felt or pipe isolators.
- Q. For condensate piping, provide minimum 3" deep seal trap and plugged cleanout tee at the equipment connection. Slope piping at $\frac{1}{4}$ " per foot minimum.
- R. Provide and install polished chromium plate split ring escutcheons for pipes exposed in the building.

3.03 CLEANOUTS:

- A. Cleanouts shall be caulked into or clamped to pipe where shown on plans. Install under counter tops where they occur or in walls to avoid exposed condition. Cleanouts shall be accessible in all cases and shall be brought to surface on "Y" branches. All cleanouts shall be provided with removable floor or wall plate as specified in Part 2.

3.04 PIPE HANGER AND SUPPORTS:

- A. Installation shall comply with the currently accepted edition of the California Plumbing Code.
- B. Piping shall be firmly held in place by adjustable split ring malleable iron hangers, supports and pipe rests, located adjacent to fitting at each offset or change of direction, at the ends of branches over 5' long, at base of riser pipes and along piping where necessary to prevent sags, bends, or vibration. All hangers and supports shall be of design which will support weight of pipe, fluid and insulation and prevent sagging.
- C. Pipe clamps shall be heavy gauge iron, factory fabricated to fit against supporting surface when installed. Makeshift devices will not be acceptable. Plumbing tape is not allowed.
- D. Seismically brace all piping and equipment as specified in Section 15050 and per California Building Code.
- E. Hangers supported by concrete structure shall be attached by cast-iron manufactured concrete inserts installed at the time concrete is poured and each insert shall be provided with through rods lapped over structural reinforcing. Power driven fasteners are not acceptable.
- F. Hangers supported by structural steel shapes shall be attached by cast-iron clamps designed for use on the specific steel shape and equipped with retainers.
- G. All hangers shall be attached to halter rods by means of adjustable swivel, turnbuckle or double nut arrangement to allow height adjustment.
- H. Vertical piping shall be suitably supported from the building structure where required by means of malleable iron or steel pipe clamps of ample size, either bolted or welded to the pipe and supported at the floor slab. Supports shall also act as anchors to allow for expansion and contraction of the piping. Provide rubber isolators for clamps where required for elimination of vibration and sound to the structure. Vertical "no-hub" components shall be secured at each joint and at each floor.
- I. Miscellaneous Supports: Floor and wall brackets, etc., shall be provided where required in accordance with the best standard practice of the trade. In the event additional structural steel is required to transmit loads to maintain structure, same shall be provided at no additional cost to the Owner.
- J. Support of piping, tubing, and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods shall not be allowed.

K. Horizontal Cast-Iron Piping:

1. Supports shall maintain alignment and prevent sagging and shall be placed within 18" of the hub or joint. When the developed length between supports exceeds 4 feet, they shall be provided at each side of every joint. Supports shall also be provided at each horizontal branch connection. Suspended lines shall be braced to prevent horizontal movement as specified in Section 15050.
2. Hanger rod sizes shall be in accordance with Table 3-1 of the California Plumbing Code.
3. Trap arms and similar branches shall be firmly secured against movement in any direction. Closet bends shall be stabilized by firmly clamping and blocking. Where vertical closet stubs are used they shall be completely stabilized against all movement.

L. Horizontal copper tubing and steel pipe spacing shall be in accordance with Table 3-2 of the California Plumbing Code.

M. All hangers for water piping shall be sized for use over trisolator or 1-inch hair felt.

3.05 SLEEVES AND OPENINGS

A. Provide standard weight black steel pipe sleeves for each pipe passing through foundation, walls, partitions, roofs, and ceiling. Pipe sleeve shall be flushed with wall or floor.

1. Set pipe sleeves in place before concrete is poured.
2. For uninsulated pipe, provide sleeves that are two pipe sizes larger than the pipe passing through the opening, or provide a minimum of ½" clearance between inside of the opening and outside of the pipe.
3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering with clearance for packing and caulking.

B. Caulk the space between sleeve and pipe or pipe covering.

C. Finish and Escutcheons

1. Smooth up rough edges around sleeves with plaster or spackling compound.
2. Provide escutcheons on all pipes exposed to view where passing through walls, partitions, ceilings, and similar locations.
 - a. Size the escutcheons to fit pipe and covering.
 - b. Hold escutcheons in place with set screw, or set in full bed of sealant.
 - c. Where directed by Architect, paint escutcheon to match adjacent finish color.

D. Sleeve diameter for piping through a masonry wall above grade or through floors shall be #10 gauge galvanized sheet steel and shall extend completely through the walls or floor finishing flushed on both sides. The sleeve shall be 1" larger than the pipe with caulking to make the opening airtight.

E. Sleeves through the fire walls or floors shall be packed with UL Listed fireproof wicking or other suitable noncombustible material.

3.06 VALVES:

- A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus and fixtures.
- B. Provide valves in at least the following locations:
 - 1. In branches and/or headers of water piping serving a group of fixtures.
 - 2. Shut-off valves at piping supply.
 - 3. For shutoff of risers and branch mains.
 - 4. For flushing and sterilizing the system.
- C. Locate valves for easy accessibility and maintenance.

3.07 WATER HAMMER ARRESTORS:

- A. Provide water hammer arrestors on hot water lines and cold water lines.
 - 1. Install in upright position at all quick closing valves, solenoids, isolated plumbing fixtures, and supply headers at plumbing fixture group.
 - 2. Locate and size in accordance with Plumbing and Drainage Institute Standard WH-201.
 - 3. Install water hammer arrestors behind access panels or ceiling panels.

3.08 FIXTURE INSTALLATION:

- A. All plumbing fixtures shall be bedded and caulked along joint at walls, counter tops, and other intersecting surfaces with white adhesive caulking.
- B. Plumbing fixture trim and exposed supplies and "P" trap and arm shall be brass with polished chrome plated finish. Individual wheel handle, loose key stops, or, when so specified, screwdriver stops, shall be provided for all supplies, and unless integral with valves or faucets, or unless otherwise permitted, shall be mounted under the fixture. Exposed supplies and wastes to wall shall be provided with polished chrome plated brass wall escutcheons.
- C. Fixtures with hangers or supporting arms shall have hangers or arms securely mounted on a ¼" thick x 6" wide steel wall plate which shall extend at least one stud beyond the first and last fixture mounting points. Concealed arm assemblies shall be attached to plates by four ¾" x 1-¼" steel bolts and nuts, and hangers and exposed arms by 5/16" minimum full thread steel studs and jamb nuts. Plates shall be drilled and tapped at the time of fixture installation.
- D. Wall plates shall be recessed flush with studs and shall be securely attached to each stud crossed. In steel stud construction, a 1-½" x 18" long furring channel shall be attached to each notched stud with fillet welds 1" long on 6" centers front and back. Plates shall be continuous fillet welded at both top and bottom to each furring channel. Provide backing for each plumbing fixture requiring same, at the time roughing-in is done.
- E. Where drains are specified with clamping collars, the water proofing membrane and flashing shall be carefully cut to fit the drain, then anchored between drain and collar with rustproof bolts. See Part 2 for flashings.
- F. Traps above floor shall be cast brass "P" traps with bronze nuts unless otherwise indicated.
- G. Provide branch tailpieces off air vent lines where required.

- H. Install stainless steel mounting ring as required for all flat rim sinks and lavatories installed in counter tops.
- I. All fixtures designated for use by the disabled shall be in compliance with current applicable codes, Title 24, and *California Disabled Accessibility* guide book.
 - 1. Water Closets: Installed height shall be a minimum of 17" and a maximum of 19" measured to the top of the toilet seat. Flush controls shall be operable by an oscillating handle with a maximum operating force of 5 lbf. The handle shall be located so it is operable without requiring excessive body movement.
 - 2. Lavatories: Lavatories shall be mounted with a clearance of at least 29" from the floor to the bottom of the apron with knee clearance under the front lip extending a minimum of 30" in width with 8" minimum depth at the top. Toe clearance shall be the same width and a minimum of 17" deep from the front of the lavatory. Hot water and drain pipes under lavatories shall be insulated. There shall be no sharp or abrasive surfaces under lavatories. Lever-operated faucet controls shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf.
 - 3. Urinals: The elongated rim on urinals shall project a minimum of 14" from the wall and the height of the rim shall be at a maximum of 17" above the floor. Hand operated controls shall be mounted no more than 44" above the floor.
 - 4. Drinking Fountains: The drinking fountain shall be a minimum of 18" depth. Provide clear and unobstructed space not less than 27" in height and 18" in depth, the depth measurements being taken from the front edge of the fountain. The bubbler shall be activated by a hand-operated lever type control located within 6" of the front of the fountain. The bubbler outlet orifice shall be located within 6" of the front of the drinking fountain and shall be within 36" of the floor. The water stream from the bubbler shall be substantially parallel to the front edge of the drinking fountain.
- J. Fit-up connections to equipment (furnished by others) shall be provided with valves, unions, flexible connectors, and adapters to make a final connection. Piping stubouts for equipment will be extended to make the final connection. The connection shall be made with devices recommended by the equipment manufacturer. Field verify exact point of connection prior to start of work.

3.09 SEISMIC RESTRAINT:

A. General:

- 1. Furnish and install seismic restraint for all piping, equipment, etc., installed under the contract. All restraints shall meet the requirements of the current California Building Code.
- 2. Seismic restraints shall be designed and installed in accordance with good engineering practice to the approval of a Professional Engineer. The design and installation of restraints shall be generally in accordance with the current editions of the California Building Code all of which shall form and become a part of this installation.
- 3. Water heater installed in seismic zones shall be supported from the adjoining structure by the use of DSA approved safety restrain devices. Use QuickStrap from Hubbard Enterprises/HOLDRITE or Owner-approved equivalent.

3.10 PROTECTION OF PIPING SYSTEMS:

- A. It shall be the responsibility of the Contractor to install and maintain pipe and equipment which is reasonably clean and free from rust, dirt, scale, etc. Where necessary, the Contractor shall provide temporary airtight covers at all pipe and equipment openings.
- B. Before turning the systems over to the Owner, all piping systems shall be thoroughly flushed of all scale and dirt. Drains shall be installed at the low points to facilitate flushing of the piping systems:

3.11 REQUIREMENTS FOR FINAL INSPECTION:

- A. All requirements shall be completed prior to final inspections.
- B. Thoroughly clean all parts of the piping, valves, and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster, oil and grease spots. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
- C. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots, leaving a smooth and clean surface. Trap elements shall be removed during the cleaning and flushing period, after which they shall be replaced and adjusted.
- D. Electrical device covers shall not be installed until the finished coating of paint is completed. Device handles and receptacles shall be covered and/or protected during the painting operation to preserve the original factory bright new finish.
- E. All potable water lines shall be sterilized with chlorine. The chlorine residual concentration shall indicate not less than 50 parts per million (ppm) and shall be retained for a period of not less than 24 hours. Repeat procedure if the residual concentration has decreased below 25 PPM. After test is in compliance with this specification, flush the system until the residual is not more than 0.5 PPM. All work and certification of performance must be done by qualified personnel. Submit certification to Architect.

NOTE: During construction phase, install Tee's and ball valves at locations directed to facilitate sterilization. Identify and indicate on the as-built plans the location of valves and ensure that they are accessible and are in a position not to cause cross-connections or artificial pressure loss in the system.

3.12 TESTS AND ADJUSTMENTS:

- A. No piping work, fixtures, or equipment shall be concealed or covered until inspected by the Architect/Owner's Representative, who shall be notified when the work is ready for inspection. All work shall be completely installed, tested as required by local code, this section and the State Ordinances and State Safety Orders, and shall be leak-tight before inspection is requested. All tests shall be repeated as required by those making the inspection.
- B. All domestic water piping shall be flushed out, tested at 150 psig and shall be left under pressure of supply main or a minimum of 50 psi, whichever is greater, for the balance of the construction period. No air testing is allowed. Tests are to be applied for a minimum period of one hour. Final pressures at the end of the test period shall be not more nor less than that caused by expansion or contraction of the test medium due to temperature changes.
- C. Soil, waste, vent, and condensate piping within the building shall be tested with a minimum of 10-foot head at each joint for a minimum of 3 hours with no loss in head.

- D. Plumbing fixtures shall be filled with water and checked for leaks and retarded drainage flow. Faucet aerators and shower heads shall be removed and cleaned thoroughly and flow shall be adjusted to eliminate dripping or splashing.
- E. Final pressures at the end of the test period shall be no more nor less than that caused by expansion or contraction of the test medium due to temperature changes.
- F. All protective coating systems shall be visually inspected for breaks in the coating system, any holidays revealed shall be promptly repaired per manufacturer's instructions for repair of damaged pipe coatings.

3.13 DRAWINGS OF RECORD:

- A. In addition to the "As-Built" drawings required, two complete sets of blue line mechanical drawings shall be provided by the Architect for the purpose of showing a complete picture of the work as actually installed.
- B. These drawings shall serve as work progress report sheets and the Contractor shall make all notations, neat and legible, thereon daily as the work proceeds. The drawings shall be available for inspection at all times and shall be kept at the job at a location designated.
- C. At the completion of the work, these as-built drawings shall be signed by the Contractor indicating approval thereof, dated and returned to the Architect.
- D. The dimensions, locations and invert elevations of buried piping shall be accurately recorded on the as-built drawings. Dimensions shall be from permanent building walls (not from column lines).

3.14 GUARANTEE:

- A. All work under this section shall be guaranteed in writing in accordance with the "Mechanical General Provisions," Section 15050.
- B. All material except as otherwise noted shall be new, free from defect and of the quality and rating shown or specified.
- C. Any defect due to missing or improper material or faulty workmanship existing or developing during the warranty period shall be corrected and the resulting damage repaired.
- D. The warranty period shall be one year from date of acceptance of the project, except for items guaranteed by the manufacturer for a longer period.

3.15 OPERATING INSTRUCTION AND SERVICE MANUAL:

- A. The Contractor shall carefully prepare an operating instruction and service manual for the entire system including all equipment, excepting Owner-furnished equipment. The manual shall be submitted for review to the Architect at least 30 days prior to completion of the work. Failure to submit manual will delay final inspection and acceptance of the work. Contents shall be bound in a durable loose-leaf binder, complete with index.
- B. The following items shall be included in the manual. This list may not be complete and is to be used as a guide:
 - 1. Part numbers of all replaceable items.
 - 2. Manufacturer's cut sheets and rating tables, including brochures on all fixtures, equipment and materials installed.

3. Oiling, lubrication and greasing instructions, including maintenance time schedule.
 4. Test data on all equipment.
 5. Serial numbers of all principal pieces of equipment.
 6. The names, addresses, phone and emergency phone numbers of the manufacturers' and subcontractors' suppliers.
 7. Valve chart indicating location of valves for the project.
 8. Written guarantee.
 9. Prints of complete as-built drawings, signed by the Contractor.
 10. Reviewed submittal data and shop drawings in binder.
 11. Test and balance data and copies of building inspections check lists signed off by the Inspector.
 12. Potable water piping sterilization certificate.
 13. Pipe and equipment identification schedule.
- C. After review of the manual by the Engineer, two copies of each manual shall be furnished for distribution.

3.16 IDENTIFICATION OF PIPING AND EQUIPMENT:

- A. Identify all equipment with nameplates bearing equipment name and number using 1-½" wide, white Bakelite with ½" black letters permanently mounted in a conspicuous place.
- B. Markings: Each piping system shall be identified and the direction of flow indicated by means of legends, color bands and flow arrows, all as manufactured by W.H. Brady, Seton or equal. The markings shall be applied after all painting and cleaning of the piping and insulation is completed. The stick-ons shall be taped all around the pipe in addition to being cemented on.
- C. Location:
 1. The identification shall be applied to all piping except those located in furred spaces without access to permit entrance of personnel and piping buried in the ground or concrete.
 2. The symbol and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping or similar obstruction and at approximately 30-foot intervals on runs with at least one symbol or flow arrow in each space or room.
 3. Variation or changes in locations and spacing may be made only with the direction of the Architect to meet conditions.
 4. Wherever two or more pipes run parallel, the printed symbol and other markings shall be applied in the same relative locations so as to be in either vertical or horizontal linearity, whichever the case may be.
 5. The markings shall be located so as to be conspicuous and legible at all times from any reasonable point.

- D. Sizes shall be as recommended in ANSI A13.1.
- E. As an alternate to the above, the Contractor may submit a system of painted stenciled letters on a color coded background per ANSI A13.1. Complete data, color chart and sizes shall be submitted for review.
- F. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts showing and identifying each valve and describing its function. Upon completion of the work and after approval by the Architect, one copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be mounted in the mechanical room where directed by the Owner. Two additional unmounted copies shall be delivered to the Owner. Valve lists shall be furnished as required.
- G. Name Tags: Provide 1¼" plastic square of 1¼" round with ¼" letters for all valves, Seton or approved equal. Black letters on white tags and marked for type of service intended. Attach tags to valve handles by "S" hooks. Furnish four printed lists showing valve number, service and location. One of these lists shall be individually framed with metal frames and glass fronts and mounted where directed by the Owner after approval. One additional copy shall be furnished as required.

3.17 BALANCING WATER SYSTEMS:

- A. The systems shall be balanced using the cocks and balance valves specified to obtain desired flow quantities through all heating elements, coils, etc. A full typed report of the balancing shall be provided to the Consultant for approval and, following acceptance of the report, a copy shall be incorporated within each maintenance manual specified. The Contractor shall include separately for his own work as required to coordinate with the testing agency and balancing water systems.
- B. Testing forms shall be equivalent to those available from A.A.B.C. and data shall consist of at least the following.
 - 1. Differential head and shut-off head across circulating pumps.
 - 2. Temperature drop across heating elements, cooling coils, heating coils, etc. Radiant ceiling systems to be balanced to give equal temperature drop.
 - 3. Flow quantities in litre/sec for all systems equipped with flow meters. Pressure drop through 3-way valve bypasses to be adjusted in proper relation to systems parts bypassed.

3.18 OPERATION:

- A. The Owner may require operation of parts or all of the installation for beneficial occupancy prior to final acceptance.
- B. Cost of utilities for such operation shall be paid by the Owner. Said operation shall not be construed as acceptance of the work.
- C. Operation Test: At completion, the Contractor shall operate all plumbing systems for a period of at least one day of 8 hours minimum to demonstrate fulfillment of the requirements of the contract. During this time all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Owner, including the location of main and branch shut-off valves.

D. Final Operation and Instruction:

1. Upon completion of the installation of the equipment and after final acceptance, at a time approved by the Owner, the Contractor shall place a competent person, or persons at the building who shall operate the systems for a period of one 8-hour day instructing the Owner's Representative in all details of operation and maintenance, including the location of main and branch shut-off valves.
2. Any required instructions from manufacturer's representatives shall be given during this period. The one day specified under "Operating Test" does not substitute for this day of final operation and instruction.
3. All arrangements for operation periods shall be made through the Owner.
4. This day of instructions shall coincide with the one day of instructions specified in Section 15800.

END OF SECTION

SECTION 15800

HEATING, VENTILATING AND AIR CONDITIONING

PART I - GENERAL

2.01 SUMMARY

- A. The responsibilities of the Contractor shall include the following systems and equipment complete, and any additional work shown on the drawings or hereinafter specified.

Computer Room Air Conditioning Systems
Exhaust Fans
Single/Dual Duct Terminal Units
Ductwork
Duct and Pipe Insulation
Air Distribution
Vibration Isolation
Automatic Temperature Control
Test and Balance

- B. The Contractor shall provide all sheet metal work as shown on the drawings or as required for the mechanical systems. Sheet metal work shall be as specified in this section.

2.02 GENERAL REQUIREMENTS:

- A. Reference to Other Sections: The applicable requirements from the following sections shall form a part of the heating, ventilating and air conditioning work and the Contractor shall consult them in detail for general and specific requirements.

Section	15050	General Mechanical Provisions
	15400	Plumbing

2.03 RELATED WORK:

- A. The following work will not be furnished under this section of the specifications but will be furnished by other trades.
1. Power voltage wiring and connections thereto and all power voltage conduit.
 2. Openings in walls, floor, roofs.
 3. Concrete work.
 4. Cutting, patching and furring.
 5. Flashing.
 6. Final painting.

2.04 SHOP DRAWINGS:

- A. Submit for approval, in accordance with Section 15050, six copies of fully dimensioned shop drawings for all specified equipment, controls and ductwork construction details. Manufacturer's equipment drawings are to be complete with capacity and sound level ratings as indicated in the drawings or specifications. Contractor shall also submit all manufacturer's internal wiring diagrams for electrical equipment and shall prepare other wiring diagrams showing the interlocking of the various controls and safety devices of the heating, ventilating and air conditioning systems. Submit performance curves for all fans. Equipment capacity tables requiring interpolation or extrapolation are not acceptable.
- B. Submit for approval, installation drawings which show exact dimensions and locations of openings required in walls for ducts, exhaust, piping etc.
- C. For duct and piping shop drawing development, the contractor shall obtain the most the current architectural, structural and electrical CAD files to be overlaid on to mechanical duct and piping shop drawings.

2.05 FILTERS:

- A. A complete set of filters shall be supplied for use during the construction, testing and balancing period. A complete set of new filters shall be installed after testing and balancing.

2.06 EQUIPMENT START-UP:

- A. Provide the services of manufacturer's factory-trained service representative to start-up VAV units. Include in start-up, testing controls, demonstration of compliance with requirements, and replacement of damaged or malfunctioning controls and equipment.

PART 2 - PRODUCTS

2.01 DUCTWORK AND ACCESSORIES:

- A. Supply ducts, return ducts, and exhaust ducts, plenum chambers, housing, panels, unless otherwise specified herein or on the drawings, shall be fabricated from zinc-coated (galvanized) steel sheets conforming to the latest ASTM specification A-653. Zinc-coating shall be of the "Commercial" class. Where gauge numbers of metals are indicated or specified, they shall represent the manufacturer's standard gauge numbers, prior to galvanizing.
- B. Volume Dampers:
 - 1. Damper blades shall be manufactured of 16 gauge sheet metal.
 - 2. Rectangular dampers shall be opposed blade type. Frame shall be 16 gauge galvanized steel. Where dimensions of duct exceed 18" x 12", blades shall not be over 8" wide. Bearings shall be provided; holes punched in ductwork to serve as bearings will not be accepted. Locking quadrant sizes shall be as follows: Up to 40 square-inches shall be 1/4 quadrant; up to 18" x 12" shall be 1/2 quadrant, and over 18" x 12" shall be 3/4 quadrant.
 - 3. Round dampers up to 9" diameter may be installed in sheet metal spin fittings when used for balancing air distribution devices. Frames for dampers 10" diameter and above shall be 16 gauge galvanized steel. Dampers above 20" diameter shall be reinforced. Quadrant sizes shall be as follows: up to 9" diameter shall be 1/4 quadrant, 10" through 20" diameter shall be 1/2 quadrant, and over 20" diameter shall be 3/4 quadrant.

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C. Fire/Smoke Assemblies: Furnish and install all fire and smoke damper assemblies as required by the NFPA pamphlet 90A and local authorities having jurisdiction. Dampers shall be complete with damper actuator activated by duct mounted smoke detector or fire stat. (Projects with central fire control panel shall have dampers provided with two damper position switches linked to damper blade.) The damper assembly shall be approved and listed by the State of California Fire Marshal.

D. Access Doors:

1. Duct access doors to all smoke/fire dampers shall be insulated type as manufactured by Duro Dyne, Pottorff, Karp or equal. Doors shall be 24 gauge metal, 24 gauge frame, insulation shall be 1" fiberglass, covered with 28 gauge metal, with loose pin hinges, and cam-lock latches. Door frame shall contain foam gasket, and a sponge rubber gasket shall be attached to back of each door frame to insure tight seal between duct and frame. Finish shall be factory applied. Service shall be stenciled on door, e.g., "Smoke/Fire Damper" in 1/2 letters. Size shall be 16" by 12" where space and duct size permit. On small ducts and in restricted space, 12" x 10" may be used.
2. Access doors installed in round ductwork shall be rolled plate and shall be at least 2 gauges thicker than the gauge required for the duct. Doors shall be close-fitting with foam strip gasket and a minimum of 2 quick fastening latches. Doors for ducts up to 12" diameter shall be provided with 2 hinges and for ducts above 12" diameter provide one continuous hinge.

E. Flexible Connectors: Furnish and install connections at the point where ductwork casing connects to fans, and where shown on the drawings. Connectors shall be manufactured by Duro Dyne. Indoor flexible connectors shall be Neoprene #10003 MFN metal fab. Outdoor flexible connectors shall be Duroion #10002 MFD metal fab. Connectors shall be securely clamped to ductwork, fans and apparatus by means of bolted metal straps.

F. Flexible Ducts:

1. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 1 1/2" thick fiberglass insulation ($K = .25 \sim 75^{\circ}\text{F}$), encapsulated spring steel wire Helix and impervious smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
2. Flexible ducts shall be supported at or near mid-length with 2" wide, 28 gauge steel collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets. The maximum length shall be 7 feet and can be used at the terminal ends only, except that flexible ducts may be used to cross seismic joints without offsets.
3. Insulated low pressure flexible duct shall be Glass-Flex SL-181 as manufactured by the Glass Insulation Company, inc., Los Angeles, California or approved equal.

2.02 INSULATION:

A. Install thermal insulation on clean, dry surfaces after testing, inspection, and approval in strict accordance with these specifications, applicable drawings and contract documents and manufacturers' recommendations. Except for materials listed below, all insulation and accessory materials are to meet NFPA requirement of flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by Procedure ASTM-E-84, NFPA 225, or UL 723.

1. Excepted are:

- a. Flexible, closed cell, foamed plastic insulation (Armacell or approved equal) on water chilling units, copper tubing refrigerant piping, copper tubing runouts and drain lines only.
 - b. 8 oz. canvas jacket on exposed ductwork and equipment only.
- B. Duct Insulation: Insulate all concealed supply, return, and heating system ductwork air ducts with flexible glass fiber insulation with factory applied reinforced foil kraft facing, Manville R-series Microlite FSKL 1½" minimum thickness, density 2.0 pcf, installed "R" value of 4.5.
- C. Duct Liner: Ducts, where shown on the drawings shall be lined with 1½" minimum thickness, density 2.0 pcf, Manville "Linacoustic." The insulation shall not exceed k = .28 at 75°F mean temperature, installed R-value shall be 4.5

2.03 EQUIPMENT:

A. Computer Room Air Conditioning Systems

1. These specifications describe requirements for an environmental control system. The system shall be designed to control temperature and relative humidity conditions within the room.

The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings.

System shall be supplied with ETL and CSA (NRTL) listing according to UL 1995.

The system model number(s) shall be Liebert MM*60E/MC*65A.

2. Design Requirements

- a. The environmental control system shall be a Liebert Mini-Mate2 factory assembled unit. On direct expansion models, the refrigeration system shall be split, with the compressor located in a remote or close-coupled condensing unit.

The evaporator section shall be designed for above dropped-ceiling installation. Condensing units shall be designed for either outdoor or above-dropped-ceiling installation.

The system shall have a total cooling capacity of 59.4 BTU/hr, and a sensible cooling capacity of 52.1 BTU/hr, based on the entering air condition of 72°F dry bulb, and 63°F wet bulb.

The unit is to be supplied for operation on a 460 volt, 3 phase, 60 Hz power supply.

3. Submittals

- a. Submittals shall be provided with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical, and Capacity data; Piping and Electrical Connection Drawings.

4. Quality Assurance

- a. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot" Test (two times rated voltage plus 1000 volts, per NRTL agency requirements), and Metering Calibration Tests. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

5. Evaporator Cabinet Construction
 - a. The cabinet and chassis shall be constructed of heavy gauge galvanized steel, and shall be serviceable from one side. Mounting brackets shall be factory attached to the cabinet.
6. Air Distribution
 - a. The fan shall be the centrifugal type, double width, double inlet. The shaft shall be heavy-duty steel with self-aligning ball bearings with minimum life of 100,000 hours. The fan motor shall be 1750 rpm (1450 rpm @ 50 Hz) and mounted on an adjustable base. The drive package shall be equipped with an adjustable motor pulley. The fan/ motor assembly shall be mounted on vibration isolators.
 - b. The evaporator system shall be capable of delivering 2500 CFM at 0.5 inches (mm) of external static pressure. The fan motor shall be 1.5 HP.
 - c. System shall be suitable for ducted air distribution.
7. Microprocessor Control
 - a. The control system shall be microprocessor based. The wall-mounted control enclosure shall include a 2-line by 16-character LCD display providing continuous display of operating status and alarm condition. A 7-key membrane keypad for setpoint/program control and unit on/off shall be located below the display.
 - b. Temperature and humidity sensors shall be located in the wall-box, which shall be capable of being located up to 300 ft (91.4m) from the evaporator unit.
8. Monitoring
 - a. The LCD display shall provide on/off indication, operating mode indication (cooling, heating, humidifying, dehumidifying) and current day, time, temperature and humidity (if applicable) indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the Liebert SiteScan® monitoring system.
9. Control Setpoint Parameters
 - a. Temp. Setpoint 65-85°F (18 to 29°C)
 - b. Temp. Sensitivity 1 to 5°F (1 to 3°C)
 - c. Humidity Setpoint 20-80% RH
 - d. Humidity Sensitivity 1 to 10% RH
10. Compressor Short - Cycle Control
 - a. The control system shall prevent compressor short-cycling by a 3 minute timer from compressor stop to the next start.
11. Common Alarm and Remote On/Off
 - a. A common alarm relay shall be provided to provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote on/off control. Individual alarms shall be "enabled" or "disabled" from reporting to the common alarm.
12. Setback Control
 - a. The control shall be programmable on a daily basis or on a 5 day/2 day program schedule. It shall be capable of accepting 2 programs per day.
13. Temperature Calibration
 - a. The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 1 to 90 seconds. The control shall be capable of displaying temperature values in °F or °C.

14. System Auto Restart
 - a. For start-up after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the wall-mounted controller or from the central site monitoring system.
15. Unit Alarm
 - a. The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:
 - (1) High Temperature
 - (2) Low Temperature
 - (3) High Humidity
 - (4) Low Humidity
 - (5) High Water Alarm – Lockout Unit Operation
 - (6) High Head Pressure
 - (7) Loss of Power
 - (8) Compressor Short Cycle
16. Alarm Controls
 - a. Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm (except for high head pressure).
17. Audible Alarm
 - a. The audible alarm shall annunciate any alarm that is enabled by the operator.
18. Remote Monitoring
 - a. All alarms shall be communicated to the Liebert site monitoring system with the following information: date and time of occurrence, unit number, and present temperature and humidity.
19. Direct Expansion Coil
 - a. The evaporator section shall include evaporator coil, thermostatic expansion valve, and filter drier.
 - b. The evaporator coil shall have 5.6 sq.ft. (0.52 sq.m) face area, 4 rows deep. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 500 ft. per minute (m/s) at 2500 CFM (CMH). An externally equalized thermostatic expansion valve shall control refrigerant flow.
 - c. The coil shall be provided with a stainless steel drain pan, with an internally trapped drain line.
20. Air-Cooled Centrifugal Fan Condensing Unit
 - a. The condenser coil shall be constructed of copper tubes and aluminum fins. The condensing unit shall be factory charged with R-22 refrigerant and sealed. The condensing unit can be coupled directly to the evaporator or can be mounted remote to the evaporator.
 - b. Components shall include scroll compressor, high-pressure switch, Lee-temp refrigerant receiver, head pressure control valve, and liquid line solenoid valve.
 - c. The condensing unit shall be designed for 95°F (35°C) ambient and be capable of operation to -20°F (-29°C) ambient. The fan motor assembly shall be belt-drive.

- d. The condenser fan shall be centrifugal type, double inlet, heavy-duty steel shaft, with self-aligning bearings. The fan motor shall operate at 1750 rpm (1450 rpm @ 50 Hz), shall be equipped with adjustable motor pulley, and shall be mounted on an adjustable base. The fan and motor assembly shall be mounted on vibration isolators.
- e. A hot gas bypass circuit shall be provided to reduce compressor cycling and improve operation under low load conditions.

B. Single/Dual Duct Terminal Units

1. Furnish and install TITUS Model DESV single duct, variable air volume terminals of the sizes and capacities shown in the plans.
2. Terminals shall be certified under the ARI Standard 880 Certification Program and carry the ARI Seal. Noncertified terminals may be submitted after testing at an independent testing laboratory under conditions selected by the engineering consultant in full compliance with ARI Standard 880. These tests must be witnessed by the engineering consultant with all costs to be borne by the terminal manufacturer. Testing does not ensure acceptance.
3. The terminal casing shall be minimum 22-gauge galvanized steel, internally lined with ½-inch dual density insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with NFPA 90A approved sealant to prevent entrainment of fibers in the airstream. The discharge connection shall be slip and drive construction for attachment to metal ductwork. The casing shall be constructed to hold leakage to the maximum values shown in the Casing Leakage table.
4. The damper shall be heavy gauge steel with shaft rotating in Delrin® self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage to the maximum values shown in the Damper Leakage table.
5. Actuators shall be capable of supplying at least 35-inch lbs. of torque to the damper shaft and shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork. Casing with access panel shall be constructed to hold leakage to the maximum values shown in the Casing Leakage table.
6. At an inlet velocity of 2000 fpm, the minimum static pressure required to operate any terminal size shall not exceed 0.13-inch wg for the basic terminal.
7. Sound ratings for the terminal shall not exceed 35 NC at 0.5" static pressure. Sound performance shall be ARI certified.

C. Accessories

1. Hot Water Reheat Coils
 - a. Hot water reheat coils shall be enclosed in a minimum 20-gauge galvanized steel casing with slip and drive construction for attachment to metal ductwork. Coils shall be factory installed on the terminal discharge. Fins shall be rippled and corrugated heavy gauge aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of 0.016-inch with male solder header connections. Coils shall be leak tested to 300 psi with minimum burst pressure of 1800 psi at ambient temperature. Number of coil rows and circuits shall be selected to provide performance as required per the plans. Coil performance data shall be based on tests run in accordance with ARI Standard 410.

- D. ATC equipment providers with 0-20mA or 4-20mA signals shall supply and install a suitable dropping resistor to convert the current signal to a 0-10VDC signal or 2-10VDC signals:

1. PWM heat
2. 2 stage heat
3. 0-10V / 0-20mA
4. 2-10V /4-20mA
5. Incremental T-stat
6. Binary
7. 3 point floating

- E. A downstream air temperature limit and control shall be automatically invoked by adding a downstream air temperature sensor. When invoked, the downstream air from the heater shall not exceed an adjustable maximum temperature set point. When the ATC's call for heat is less than 100%, the heater shall control the downstream air temperature to a point in proportion to the span between the heater's probable entering air temperature and the maximum air temperature set point.

- F. The proportional electronic airflow sensor shall be totally independent of the duct static pressure and shall adjust the heater capacity according to the available airflow. The heaters shall deliver maximum heating when needed with normal minimum airflow, reduce heating with lower than minimum airflow and stop heating with no airflow. Unit shall include an integral door interlock type disconnect switch which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

- G. Exhaust Fans:

1. Ceiling Exhaust Fans:
 - a. Ventilator shall have steel housing finished in baked enamel and insulated with at least 1/2" acoustic insulation. Housing shall have adjustable mounting brackets.
 - b. Automatic Backdraft Damper shall be located within duct connector, and shall have cushioned stops to prevent clatter. Damper/duct connector and wiring adapter plate shall be adjustable for either horizontal or vertical installation.
 - c. Blower shall be removable and shall have a centrifugal blower type wheel. All motors are to be lifetime lubricated type, mounted with neoprene torsion mounts to isolate vibration. RPM not to exceed number listed for each model.
 - d. Air Delivery shall be no less and sound levels no greater than listed for each model. All air and sound ratings shall be certified by AMCA. Units shall be UL listed.

2.04 AIR DISTRIBUTION:

- A. Performance: Shall provide the required air throw and spread with no apparent drafts or excessive air movement within the air conditioned area. Any air distribution accessories required to effect these conditions shall be provided and installed by the Contractor. Grilles, registers or ceiling diffusers causing excessive air movement, drafts or objectionable noise, shall be replaced at no cost to the Owner. Paint inside of all ducts including volume dampers, etc., behind registers and diffusers with two coats flat black enamel.

- B. Locations: All devices shall be installed in approximately the location indicated on the drawings but the Contractor shall verify the exact locations at the building, and with the drawings, making any minor changes as may be required and as approved by the Owner.
- C. Air Distribution shall be "Titus" Manufacture of the model numbers listed, Metal Aire or Krueger.

LAY-IN TYPE CEILING	
Ceiling Diffusers:	Model TMS 24 x 24 panel, Type 4 Frame, Full-Face Lay In
Return Registers:	Model PAR3FW, Perforated 24 x 24 panel, Type 4 Border
PLASTER CEILING	
Ceiling Diffusers:	Model TMS, Flush Face, Surface Mount
Return Registers:	Model PAR3FW, Perforated, Flush Face, Surface Mount

2.05 AUTOMATIC TEMPERATURE CONTROL:

- A. Summary: The temperature control manufacturer as described under this heading shall furnish and install a complete system of automatic controls as shown on plans and as specified hereinafter. All control equipment shall be the product of one manufacturer and shall be basically of the electric type. Control equipment shall be coordinated with owner prior to start of work. The control manufacturer shall have a representative sample of local jobs to validate performance and shall have a maintained a full-time local service organization for at least three years.
- B. Drawings and Checkout: The Temperature Control Contractor shall submit shop drawings of the entire control system to the Architect for approval before starting work. The control system shall be completely checked out, adjusted and calibrated to perform all required functions for proper operation.
- C. Electrical Wiring: See paragraph 3.7 of this section.

PART 3 - EXECUTION

3.01 DUCTWORK:

- A. Ductwork fabrication and installation shall conform to the recommendation of the latest edition of the duct construction standards as published by the Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA). These standards shall govern type of seams and joints, reinforcing and supports, corner closures duct hangers, elbows, tapers offsets; streamliners, branches from mains, tee connections, volume dampers, access doors in ducts, smoke/fire damper installation, casings and housing. All unwrapped exposed ducts shall be cross-broken; beading will not be acceptable. Ducts that are wrapped shall be cross-broken or beaded.
- B. Volume dampers shall be caulked in the ducts to avoid bypass. Damper blade position on all dampers shall be indicated by filing a notch in the exposed operation rod or splitter damper rod. Volume control dampers shall be installed in all branch ducts, whether shown on drawings or not, to allow balancing of the system. Where damper frames and blades constitute an obstruction in excess of 15 percent of the duct area, the duct shall be increased in size to receive the damper.

- C. All supply, return, and exhaust duct joints shall be sealed airtight with approved mastic.

3.02 PIPING INSTALLATION:

- A. Pipe Sleeves: Provide pipe sleeves for all pipes and tubing which penetrate the building structure. Sleeves shall be securely retained in position and location before and during construction. Space between pipe and sleeves, shall be not less than 1/4" between outside of pipe and inside wall of sleeves. Pack the annular space with hemp or fiberglass, and seal with elastic cement. Sleeves for uninsulated pipes shall have ends flush with finished wall surfaces and the pipe or tubing shall be provided as above, with outside perimeter of pipe caulked to the sleeve. Extend sleeves for lines passing through floors 3" above finished floor slab, and caulk to the slab. Provide lines passing through roof areas with necessary flashing and counterflashing to provide a water-tight roof seal.
- B. Leak testing upon completion of installation of the air conditioning equipment, test all factory as well as field refrigerant piping with an electronic-type leak detector to acquire a leak-tight refrigerant system. If leaks are detected at the time of installation or during the guarantee period, remove the entire refrigerant charge from the system, correct the leaks and retest the system.
- C. Evacuation, Dehydration, and Charging: After system is found to be without leaks, evacuate the system using an electronic gage with range accurate to 10 microns and a vacuum pump capable of pulling a vacuum of at least 1 mm Hg absolute. Evacuate system in strict accordance with the triple-evacuation and blotter method or in strict accordance with equipment manufacturer's printed instructions. System leak testing, evacuation, dehydration, and charging with refrigerant shall comply with ARI 260.

3.03 INSULATION INSTALLATION:

- A. Insulate no piping or equipment until tested and approved for tightness. All piping shall be dry when insulated.
- B. Ductwork Insulation:
1. Supply Air Ductwork Above Ceiling: Secure insulation to duct with mechanical fasteners on 18" centers or on underside of rectangular ducts over 30" wide. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3" wide strips of the same facing material adhered with vapor barrier adhesive, Manville Z-Glue or approved equal, or 3" wide strips of white glass fabric, Manville Duramesh Fabric No. 206 or approved equal, coated with vapor barrier mastic, Foster 30-35 or approved equal.
 2. Return Air Ductwork Above Ceiling: The insulation shall be wrapped entirely around the duct with all joints lapped at least 2" and secured with 16 gauge galvanized wire on 12" centers. The insulation shall cover all surfaces including standing seams.

3.04 EQUIPMENT INSTALLATION:

- A. The installation of all air conditioning equipment and exhaust fans shall be strictly in accordance with the manufacturer's instruction and installation book. All recommendations of manufacturer shall be followed, required clearances maintained, and factory approval secured for each installation. All equipment shall be securely fastened to its base. All parts of the installation shall be made weatherproof. A copy of the manufacturer's installation and service manual shall be kept with each piece of equipment at all times to allow an inspector to determine if the installation meets requirements.
- B. All work shall be performed by skilled mechanics, under the supervision of a competent foreman and in accordance with the best standards of practice of the trade.

3.05 IDENTIFICATION OF MECHANICAL EQUIPMENT:

- A. Equipment: Equipment shall be identified by stenciling the identification plainly (such as EF-1-1 as shown on equipment schedule) on the service side. Lettering to be minimum size of 1". This applies to fans, VAV boxes, etc.

3.06 ELECTRICAL WORK:

- A. Power voltage wiring and connections thereto and all power voltage conduit shall be furnished and installed under the Electrical Division of the specifications.
- B. Low voltage and line voltage control wiring and connections thereto and all low and line voltage control conduit shall be furnished and installed under the Mechanical Sections of the specifications.
- C. Relays, push button stations, control equipment, etc., shall be furnished under the Mechanical Section of the specifications, except as noted on the drawings. Check drawings closely for starters that will be furnished under the Electrical Division which will be in Motor Control Panels. Magnetic motor starters, except those furnished with packaged mechanical equipment, will be furnished under Mechanical Division.
- D. Disconnect switches shall be furnished, installed and connected under the Electrical Division of the specification.

3.07 EARTHQUAKE RESTRAINT:

- A. Provide a means to prohibit excessive motion of all mechanical equipment during an earthquake.
- B. All mechanical equipment, both hanging and base mounted, shall be provided with mounting connection points of sufficient strength to resist lateral seismic forces equal to 0.5 of equipment operating weight.

3.08 SHOP PRIMING PROCEDURES:

- A. Ferrous metal items, except items to be encased in concrete and areas adjacent to field welds shall be thoroughly cleaned and prime painted.
- B. Surfaces shall be cleaned free of loose mill scale, loose rust, accessible weld slag or flux deposit, dirt and other foreign matter by hand wire brushing. Oil and grease deposits shall be removed by solvent.
- C. After cleaning, surfaces shall be given one shop coat of prime paint applied thoroughly and evenly to dry surfaces. Surfaces inaccessible after assembly or erection shall be given an additional shop coat of slightly different color than first coat.
- D. After erection, rough up with prime paint all members where shop coat has been damaged, welds and area adjacent to welds and field bolts.

3.09 TEST AND BALANCE:

- A. Testing Procedure: The Contractor shall perform the testing and balancing of air and water systems in accordance with AABC National Standards for field measurement and instrumentation, Volume 1, NEBB, or TABB. All tests described in same shall be performed the same as if written herein.
- B. References

1. AABC — National Standards for Total Systems Balance
2. ADC — Test Code for Grilles, Registers, and Diffusers.
3. ASHRAE 111 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems.
4. NEBB — Procedural Standards for Testing, Adjusting, and Balancing.
5. SMACNA — HVAC Systems Testing, Adjusting, and Balancing.
6. TABB — International Standards for Environmental Systems Balance.

C. Submittals

1. Submit name of testing, adjusting, and balancing agency for approval within 30 days after award of contract.
2. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
3. Submit draft copies of report for review prior to final acceptance of project. Provide final copies for architect/engineer and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, binder manuals, and complete with index page and indexing tabs with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.

D. Quality Assurance

1. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, or NEBB Standards — Procedural Standards for Testing, Adjusting, and Balancing or Environmental Systems or Testing, Adjusting, and Balancing Bureau (TABB) - National Standards for Environmental Systems Balance.
2. Maintain one copy of applicable standards on site.

E. Qualifications

1. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this section with a minimum of 3 years of experience.

F. Products

1. Replacement of adjustable pulleys, additional balancing dampers, additional fan belts, pressure taps, and fitting, hydronic balancing valves and any other devices or equipment required to effect proper testing, adjusting, and balancing shall be provided by the Contractor at no additional cost to the Owner.

G. Execution

1. Examination: Verify systems are complete and operable before commencing work. Ensure the following conditions:
 - a. Systems are started and operating in a safe and normal condition.

- b. Temperature control systems are installed complete and operable.
 - c. Proper thermal overload protection is in place for electrical equipment.
 - d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - e. Duct systems are clean of debris.
 - f. Fans are rotating correctly.
 - g. Fire and volume dampers are in place and open.
 - h. Air coil fins are cleaned and combed.
 - i. Access doors are closed and duct end caps are in place.
 - j. Air outlets are installed and connected.
 - k. Duct system leakage is minimized. Duct systems having more than 25% duct surface area in unconditioned or indirectly conditioned spaces shall be sealed with leakage not greater than 6% of fan airflow, confirmed through diagnostic testing and field verification.
 - l. Hydronic systems are flushed, filled, and vented.
 - m. Service and balance valves are open.
- 2. Submit field reports. Report defects and deficiencies noted during performance of services, which prevent system balance.
 - 3. Beginning of work means acceptance of existing conditions.

H. Installation Tolerances

- 1. Air Handling Systems: Adjust to within plus or minus 6 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- 2. Air Outlets and Inlets: Adjust total to within plus 6 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- 3. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

I. Adjusting - General

- 1. Ensure recorded data represents actual measured or observed conditions.
- 2. Permanently mark setting of valves, dampers, and other adjustment devices allowing setting to be restored. Set and lock memory stops.
- 3. After adjustment take measurement to verify balance has not been disrupted or that such disruption has been rectified.
- 4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

5. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
6. Check and adjust systems approximately 6 months after final acceptance and submit report.

J. Air Systems Procedure

1. Test and adjust fan RPM to design requirements.
2. Test and record motor full load nameplate rating and actual ampere draw.
3. Test and record system static pressures, fan suction, and discharge.
4. Adjust all main supply and return duct to properly design CFM.
5. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity FPM and as adjusted velocity design CFM and adjusted CFM.
6. Test and record outside, mixed air, and discharge temperatures (db for heating cycle, db and wb for cooling cycle).
7. In coordination with the ATC Contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
8. Test and adjust air handling and distribution systems to provide required or design supply, return, outside and exhaust air quantities.
9. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
10. Measure air quantities at air inlets and outlets.
11. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
12. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
13. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
14. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
15. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
16. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
17. Measure temperature conditions across air, return air, and exhaust dampers to check leakage.

18. Where modulating dampers are provided, take measurement and balance at extreme conditions.
19. Measure and record pressure differentials between designated spaces such as operating rooms, sterilizer rooms, medical gas tank rooms, red bag storage rooms, etc.

K. Water System Procedure

1. Prepare itemized equipment schedules, listing all heating elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating, all zone balancing valves circuit pump, and ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions, and measured conditions. Prepare individual report sheets for each zone or circuit.
2. Adjust water systems to provide required or design quantities.
3. Use calibrated Venturi tubes, orifices, or other metered fitting and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, balance flow balance on temperature difference across various heat transfer elements in the system.
4. Adjust systems to provide specified pressure drops and flow through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
5. Effect system balance with automatic control valves fully open to heat transfer elements.
6. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
7. Test pumps and adjust flow. Record the following on pump report sheets:
 - a. Suction and discharge pressure.
 - b. Running amps and brake horsepower of pump motor under full flow and no flow conditions.
 - c. Pressure drop across pump in feet of water and total GMP pump is handling under full flow conditions.
8. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

L. Required Reports To Be Submitted

1. Report Forms
 - a. Title Page
 - (1) Name of Testing, Adjusting, and Balancing Agency
 - (2) Address of Testing, Adjusting, and Balancing Agency

- (3) Telephone Number of Testing, Adjusting, and Balancing Agency
- (4) Project Name
- (5) Project Location
- (6) Project Architect
- (7) Project Engineer
- (8) Project Contractor
- (9) Project Altitude
- (10) Report Date
- b. Summary Comments
 - (1) Design Versus Final Performance
 - (2) Notable Characteristics of System
 - (3) Description of System Operation Sequence
 - (4) Summary of Outdoor and Exhaust Flows to indicate of Building Pressurization
 - (5) Nomenclature used Throughout the Report
 - (6) Test Conditions Instrument List
- c. Instrument List
 - (1) Instrument
 - (2) Manufacturer
 - (3) Model Number
 - (4) Serial Number
 - (5) Range
 - (6) Calibration Date
- d. Electric Motors
 - (1) Manufacturer
 - (2) Model/Frame
 - (3) HP/BHP
 - (4) Phase, Voltage, Amperage, Nameplate, Actual, No Load
 - (5) RPM
 - (6) Service Factor

- (7) Starter Size, Rating, Heater Elements
- (8) Sheave Make/Size/Bore
- e. V-Belt Drive
 - (1) Identification/Location
 - (2) Required Driven RPM
 - (3) Driven Sheave, Diameter, and RPM
 - (4) Belt, Size, and Quantity
 - (5) Motor Sheave Diameter and RPM
 - (6) Center to Center Distance, Maximum, Minimum, and Actual
- f. Heating Coil Data
 - (1) Number/Number
 - (2) Location
 - (3) Service
 - (4) Actual Outside Airflow
 - (5) Return Air Temperature
 - (6) Outside Air Temperature
 - (7) Required Mixed Air Temperature
 - (8) Actual Mixed Air Temperature
 - (9) Design Outside/Return Air Ratio
 - (10) Actual Outside/Return Air Ratio
- g. Exhaust Fan Data
 - (1) Location
 - (2) Manufacturer
 - (3) Model Number
 - (4) Serial Number
 - (5) Airflow, Specified, and Actual
 - (6) Total Static Pressure (Total External) Specified, and Actual
 - (7) Inlet Pressure
 - (8) Discharge Pressure

- (9) Sheave Make/Size/Bore
- (10) Number of Belts/Make/Size
- (11) Fan RPM

h. Duct Traverse

- (1) System Zone/Branch
- (2) Duct Size
- (3) Area
- (4) Design Velocity
- (5) Design Airflow
- (6) Test Velocity
- (7) Test Airflow
- (8) Duct Static Pressure
- (9) Air Temperature
- (10) Air Correction Factor
- (11) Manufacturer
- (12) Airflow, Design, and Actual
- (13) Water Flow, Design, and Actual
- (14) Water Pressure Drop, Design, and Actual
- (15) Entering Water Temperature, Design, and Actual
- (16) Leaving Water Temperature, Design, and Actual
- (17) Entering Air Temperature, Design, and Actual
- (18) Leaving Air Temperature, Design, and Actual
- (19) Air pressure Drop, Design, and Actual

i. Return Air/Outside Air Data

- (1) Identification/Location
- (2) Design Airflow
- (3) Design Return Airflow
- (4) Actual Return Airflow
- (5) Design Outside Airflow

j. Air Distribution Test Sheet

- (1) Air Terminal Number
- (2) Room Number/Location
- (3) Terminal Type
- (4) Terminal Size
- (5) Area Factor
- (6) Design Velocity
- (7) Design Airflow
- (8) Test (Final) Velocity
- (9) Test (Final) Airflow
- (10) Percent of Design Airflow

3.10 OPERATING AND MAINTENANCE MANUALS:

- A. The Contractor shall furnish three Operating and Maintenance Manuals. The information in these manuals shall be bound in a hardback, loose-leaf binder or approved equivalent. The following shall be inscribed on the cover: the words "OPERATING AND MAINTENANCE MANUAL," the name and location of the building or project, and the name of the Contractor. The following shall be included in the Manual:
1. Identification: The Manual shall include the names, addresses and telephone numbers of each Sub-Contractor installing equipment and systems and of the local representative for each major item of equipment.
 2. Index: The Manual shall have a Table of Contents and information shall be assembled with tab sheets to conform to the Table of Contents.

3.11 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. Manufacturer's Literature: Manufacturer's instructions for operation and maintenance of all mechanical equipment, including replacement parts list.
- B. Written Instruction: Typewritten instructions for operation and maintenance of the system composed of Operation Instruction, Maintenance Instructions and Maintenance Schedule.
- C. Operation and Maintenance Instructions: A brief description of the system indicating proper setting of switches and other equipment shall be furnished for the purpose of providing control of the system and its components by the operator.
- D. Maintenance Schedule: A list of each item of equipment requiring maintenance, showing all the components of each item of equipment, and the month of the year (service schedule) when each item or component of equipment should be inspected or serviced, as recommended and scheduled by the manufacturers.
- E. Verbal Instructions: Upon completion of the work, and at a time designated by the Owner, a competent Engineer from each supplier of major items or equipment shall be furnished to instruct the Owner's representative in the operation and maintenance of the equipment supplied by his company.

- F. Mounting Frames: Wood frame and glass cover of adequate size to mount directories and typewritten instructions, securely mounted where indicated by the Owner, shall be provided.
- G. Binders: A complete set of the above data along with control diagrams as installed, typewritten sequence of operations, complete catalog data, calibration information, spare parts lists, etc., for all control equipment shall be placed in a loose leaf binder with permanent cover, permanent identification section dividers and index. Provide three complete sets and deliver to the Owner.
 - 1. Manufacturer's Literature: Include Manufacturer's literature for all mechanical equipment. All equipment shall be identified by make, model and serial number. Electrical characteristics shall be noted. A complete parts list shall be included.
 - 2. Operating Instructions: Provide a brief description of the system including proper setting of switches and other equipment. This may be provided as a part of the manufacturer's literature. If included in literature provide an index indicating on what page each item is located. Adjustments requiring the technical knowledge of the service agency personnel need not be included.
 - 3. Maintenance Instructions: Provide a list of each item of mechanical equipment requiring inspection, lubrication or service with a description of the schedule and performance of such maintenance including types of lubricant for each item of equipment. This may be provided as a part of the Manufacturer's Literature. If included in literature provide an index indicating on what page each item is located.
 - 4. Controls: Provide system control drawings including complete catalog data, calibration information, spare parts lists, etc. A typewritten sequence shall be included with the diagram referring to component numbers or designations hereon.

3.12 POSTED OPERATING INSTRUCTIONS:

- A. Provide directories, control diagrams, and sequence of operation.
- B. The above shall be mounted in a wood frame with glass cover of sufficient size and mounted in the equipment room or where directed by the Architect.

END OF SECTION

SECTION 15900
TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY:

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.
- B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
- C. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2 SYSTEM DESCRIPTION:

- A. The entire Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/LonTalk communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Honeywell. Equivalent LonWorks products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.
- B. The Temperature Control System (TCS) as provided in this Division shall be based on the Honeywell WEBs System incorporating the Niagara Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

1.3 SUBMITTAL:

- A. Eight copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.
- B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.
- C. Submittal shall also include a complete point list of all points to be connected to the TCS. Temperature Controls Contractor shall provide necessary point lists, protocol documentation, and factory support information for systems provided.

- D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.
- E. Include the following display graphics for each of the sites:
1. Site plan view of entire campus identifying each building – include the display of outside air temperature & humidity.
 2. Individual buildings, including room layout with display of all space temperatures and occupied mode, outside air temperature & humidity.
 3. Mechanical equipment display for each AC unit to include space temperature, heating and cooling setpoints, supply air temperature, fan status, occupied mode, outside temperature & humidity.
 4. Boiler and hot water pumps showing all related points.
 5. Page showing all room temperatures, room temperature setpoints, occupied mode, AC unit fan status and AC unit mode (heating or cooling).
 6. Page showing all other miscellaneous points.
- F. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Temperature Controls Contractor shall provide as-builts for their portions of work.

1.4 SPECIFICATION NOMENCLATURE:

- A. Acronyms used in this specification are as follows:

TCS	Temperature Control System
NAC	Network Area Controller
IDC	Interoperable Digital Controller
IBC	Interoperable BACnet Controller
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network

WAN Wide Area Network

OOT Object Oriented Technology

PICS Product Interoperability Compliance Statement

B. AGENCY AND CODE APPROVALS

1. All products of the TCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
 - a. UL-916; Energy Management Systems
 - b. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "signal Equipment"
 - c. CE
 - d. FCC, Part 15, Subpart J, Class A Computing Devices

C. SOFTWARE LICENSE AGREEMENT

1. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
2. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

D. DELIVERY, STORAGE AND HANDLING

1. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

E. JOB CONDITIONS

1. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

PART 2 - MATERIALS

2.1 ACCEPTABLE CONTROL MANUFACTURER/CONTRACTOR:

- A. The Temperature Control System (TCS) shall be based on the Honeywell WEBs-AX Control System incorporating the Niagara Framework™. Alternates/substitutions shall be reviewed for equality prior to the award of controls contract.
- B. The Control Manufacturer/Contractor shall be a Honeywell "Authorized Controls Integrator", the Local Honeywell Branch or approved equal.
- C. All work shall be performed by a Honeywell "Authorized Controls Integrator" or Honeywell Branch office that has a successful history in the design and installation of Honeywell WEBs-AX integrated control systems using Niagara Framework™.
- D. The installing Controls Integrator Contractor shall have a local office located within 50 miles from the site location and a minimum of ten years of integration experience installing Honeywell DDC control systems and shall provide documentation in the submittal package verifying the company's experience.
- E. The Controls Integrator Contractor shall have a minimum of three (3) employees at the local office that are fully trained and certified for the Honeywell WEBs-AX Control Systems incorporating Niagara Framework™. The Controls Integrator Contractor shall also have a minimum of two (2) employees that are fully trained and certified for Tridium R-2 as required for the migration of the existing control system into the new Honeywell WEBs-AX system. Copies of the employees Niagara Training Certificates shall be included in the submittals.
 1. The Controls Integrator Contractor shall have an Electrical C-10 License in good standing in the state of California.

2.2 GENERAL:

- A. The Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within TCS shall be Year 2000 compliant and shall be supported by compliance documentation from the manufacturer.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall TCS.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES:

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.
- C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 NETWORKS:

- A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.
- B. Local area network minimum physical and media access requirements:
 - 1. Ethernet; IEEE standard 802.3
 - 2. Cable; 100 Base-T, UTP-8 wire, category 5
 - 3. Minimum throughput; 100 Mbps.

2.5 NETWORK ACCESS:

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.6 NETWORK AREA CONTROLLER (NAC):

- A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

- B. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100 Mbps
2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A
4. One RS-485 ports
5. Battery Backup
6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
7. The NAC must be capable of operation over a temperature range of 32 to 122°F
8. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

- C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
- E. Event Alarm Notification and actions
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 - 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 - d. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - 4. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Control equipment and network failures shall be treated as alarms and annunciated.
- G. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1. Screen message text
 - 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 - 3. Pagers via paging services that initiate a page on receipt of email message
 - 4. Graphic with flashing alarm object(s)
 - 5. Printed message, routed directly to a dedicated alarm printer

H. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

I. Alarm actions may be initiated by user defined programmable objects created for that purpose.

J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

L. Provide a "query" feature to allow review of specific alarms by user-defined parameters.

M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.7 DATA COLLECTION AND STORAGE:

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

- D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- E. All log data shall be available to the user in the following data formats:
 - 1. HTML
 - 2. XML
 - 3. Plain Text
 - 4. Comma or tab separated values
- F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
- G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - 1. Archive on time of day
 - 2. Archive on user-defined number of data stores in the log (buffer size)
 - 3. Archive when log has reached it's user-defined capacity of data stores
 - 4. Provide ability to clear logs once archived

2.8 AUDIT LOG:

- A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
 - 1. Time and date
 - 2. User ID
 - 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9 DATABASE BACKUP AND STORAGE

- A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10 INTEROPERABLE DIGITAL CONTROLLER (IDC):

- A. Controls shall be Honeywell Excel 10 microprocessor based Interoperable LonWorks Controllers (IDC) or approved equal. Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark™ interoperability logo on each product delivered.
- B. HVAC control shall be accomplished using LonMark™ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks / LonMark controller defining the programming or setup of each device. The Temperature Controls Contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.
- C. The Temperature Controls Contractor shall run the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.
- D. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.
- E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- G. The Temperature Controls Contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:
 - 1. Network Variable Inputs (nvi's); name and type
 - 2. Network Variable Outputs (nvo's); name and type
 - 3. Network configuration parameters (nci, nco); name and type
- H. It is the responsibility of the Division 15 contractor to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) are provided in each IDC, as required by the point charts.
- I. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.11 GRAPHICAL USER INTERFACE SOFTWARE:

A. Operating System: *WEBSTATION-AX™*

1. The GUI shall run on Microsoft Windows XP Professional.

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

1. Create, delete or modify control strategies.
2. Add/delete objects to the system.
3. Tune control loops through the adjustment of control loop parameters.

4. Enable or disable control strategies.
 5. Generate hard copy records or control strategies on a printer.
 6. Select points to be alarmable and define the alarm state.
 7. Select points to be trended over a period of time and initiate the recording of values automatically.
- E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- H. Alarm Console
1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
 2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.12 WEB BROWSER CLIENTS:

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
 - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
 - 2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
 - 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
 - 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
 - 6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - (1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - (2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - c. View logs and charts
 - d. View and acknowledge alarms
 - e. Setup and execute SQL queries on log and archive information
 - 7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.13 SERVER FUNCTIONS AND HARDWARE:

1. Existing central server, located at the site. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.
2. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.
3. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.
4. The server shall provide the following functions, at a minimum:
 - a. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
 - b. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
 - c. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
 - d. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
 - e. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
 - f. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
 - g. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
 - h. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
 - i. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
 - (a) Routing of alarms to display, printer, email and pagers
 - (b) View and acknowledge alarms
 - (c) Query alarm logs based on user-defined parameters

- j. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
 - (a) Viewing and printing log data
 - (b) Exporting log data to other software applications
 - (c) Query log data based on user-defined parameters

2.14 SYSTEM PROGRAMMING:

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.
- C. Programming Methods
 - 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - 2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
 - 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 - 4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
 - 5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.15 LONWORKS NETWORK MANAGEMENT:

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.16 OBJECT LIBRARIES:

- A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. All control objects shall conform to the control objects specified in the BACnet specification.
- E. The library shall include applications or objects for the following functions, at a minimum:
 - 1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
 - 2. Calendar Object. The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.

3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
 4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
 5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
 6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.
- F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
 3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition.—The user must be able to specify either ---- input condition as the "on" condition.
 4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
 6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
 7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
 8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
 9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
 10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
 11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.
- G. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC): -At a minimum-provide the following as part of the standard library included with the programming software:
1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.

2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
3. For BACnet devices, provide the following objects at a minimum:
 - a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In
 - f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value
 - k. Schedule Export
 - l. Calendar Export
 - m. Trend Export
 - n. Device
4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
5. For BACnet devices, provide the following support at a minimum
 - a. Segmentation
 - b. Segmented Request
 - c. Segmented Response
 - d. Application Services
 - e. Read Property
 - f. Read Property Multiple
 - g. Write Property
 - h. Write Property Multiple

- i. Confirmed Event Notification
- j. Unconfirmed Event Notification
- k. Acknowledge Alarm
- l. Get Alarm Summary
- m. Who-has
- n. I-have
- o. Who-is
- p. I-am
- q. Subscribe COV
- r. Confirmed COV notification
- s. Unconfirmed COV notification
- t. Media Types
- u. Ethernet
- v. BACnet IP Annex J
- w. MSTP
- x. BACnet Broadcast Management Device (BBMD) function
- y. Routing

2.17 MODBUS SYSTEM INTEGRATION:

- A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
- B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
 - 1. Read/Write Modbus AI Registers
 - 2. Read/Write Modbus AO Registers
 - 3. Read/Write Modbus BI Registers
 - 4. Read/Write Modbus BO Registers
- C. The Network Area Controller shall perform all scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices.

- D. The Temperature Controls Contractor shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

2.18 OTHER CONTROL SYSTEM HARDWARE:

- A. Space Temperature Wall Module. Wall Module shall be Honeywell or equivalent.
1. Wall module shall have a 20K Ohm NTC thermistor temperature sensor with operating range of 45 to 99 F under a locking cover/enclosure with UL 916 listing designed for mounting on a standard electrical switch box.
 2. Space temperature sensors shall be accurate to plus or minus one F degree.
 3. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments
 4. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
 5. Insulating foam shall be installed on the back of all space temperature wall modules to prevent air infiltration from wall opening.
- B. Duct Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of + 0.3° F. Temperature sensors shall be Honeywell or equivalent.
1. Outside air sensors shall include an integral sun shield.
 2. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
 3. Multipoint averaging element sensors shall be provided where specified and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
 4. Pipe mount sensors shall have copper, or stainless steel separable wells.
- C. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.
- D. CO2 Sensors. CO2 sensors.
1. Manufactures: Subject to compliance with requirements, provide products by one of the manufactures specified.
 - a. Honeywell
 - b. Johnson Controls
 - c. Siemens Building Technologies
 - d. Vulcain

E. CO Gas Detection Transmitters.

1. Manufactures: Subject to compliance with requirements, provide products by the manufactures specified.
 - a. Honeywell
 - b. Vulcain
2. Gas transmitter shall be powered by the controller's power output rated at 17-27 Vac or by an external power supply rated at 17-27 Vac or 24-38 Vdc.
3. Gas transmitter shall be fully addressable capable of communicating digitally with the controller through a Modbus RS-485 communication port.
4. Gas transmitter shall incorporate an electrochemical cell. The unit's sensing cell shall compensate for variations in relative humidity and temperature to maintain high levels of accuracy.
 - a. Relative humidity operating range of 5-90%.
 - b. Temperature operating range of 32°F to 100°F (0°C to 40°C).
5. Gas transmitter shall be capable of transmitting gas concentrations through the controller or for local activation of fans or louvers (or other equipment) an optional DPDT relay 5A, 30 Vdc or 250 Vac (resistive load) will be activated at programmable set points (and programmable time delays) through the controller, when required.
6. Gas transmitter shall have a 10-step LED display (with the capability of adding an optional LCD) providing gas concentration readings. A green LED will indicate normal operation and a yellow LED will indicate fault operation, with an audible alarm (rated at no less than 65Db at a distance of three feet), which will be activated at fully programmable levels through the controller.
7. Gas transmitter shall be manufactured to UL 1244 label and CSA 22.2 within an ISO 9001-2000 production environment.
8. Gas transmitter alarm levels are to activate and the unit is to be installed in accordance with the following parameters:

TOXIC GASES	FIRST ALARM SET POINT (TLV-TWA)	SECOND ALARM SET POINT (TLV-STEL)	SENSOR LOCATION	RADIUS OF COVERAGE
Carbon Monoxide (CO)	25 PPM	200 PPM	3-5 ft above the floor	50 feet

A. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.

1. Duct and room sensors shall have a sensing range of 5% to 95%.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of -40°F to 170° F.

- B. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All external wiring shall be connected to terminal strips mounted within the panel. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

PART 3 - EXECUTION

3.2 INSTALLATION:

- A. All work described in this section shall be performed by a Honeywell "Authorized Controls Integrator" that has a successful history in the design and installation of integrated control systems using Niagara Framework™. The installing contractor shall have a local office located within 50 miles from the site location and a minimum of ten years of integration experience installing Honeywell DDC control systems and shall provide documentation in the submittal package verifying the company's experience.
- B. The Temperature Controls Contractor shall have employees at the local branch that are fully trained and certified for the Honeywell WEBS Systems incorporating Niagara Framework™. Copies of the employees Niagara Training Certificates shall be included in the submittals.
- C. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- D. Drawings of the TCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Owner shall be furnished and installed without additional cost.
- E. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.
- F. Temperature Controls Contractors shall have a C-10 License in good standing in the state of California.

3.3 WIRING:

- A. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be installed in conduit and be the responsibility of the Temperature Controls Contractor.
- B. All wiring shall be in accordance with the National Electrical Code and any applicable local codes. All TCS wiring shall be installed in the conduit types allowed by the National Electrical Code or applicable local codes. Where TCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner: — — — — —
- C. Echelon Compliant Direct Burial Cable shall be used for all underground communication bus wiring between buildings to prevent damage from moisture. The existing underground conduit systems are not watertight.

3.4 WARRANTY:

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

- B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 24 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner.
- C. The Temperature Controls Contractor shall provide phone and remote online support Monday through Friday from 7:00 a.m. to 4:00 p.m. The Contractor shall submit contact information for the dedicated staff members providing the online support service.

3.5 WARRANTY ACCESS:

- A. The Owner shall grant to this contractor, reasonable access to the TCS during the warranty period.
- B. The owner shall allow the contractor to access the TCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.6 SOFTWARE LICENSE:

- A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the "orgid" of all Niagara Framework software licenses.
- B. The owner, or his appointed agent, shall be free to direct the modification of the "orgid" in any Niagara Framework software license, regardless of supplier.
- C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required ids and passwords for access to any component or software program shall be provided to the owner.

3.7 ACCEPTANCE TESTING:

- A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- D. System Acceptance: Satisfactory completion is when this contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.8 OPERATOR INSTRUCTION, TRAINING:

- A. During system commissioning and at such time acceptable performance of the TCS hardware and software has been established this contractor shall provide both off-site and on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by factory-trained personal that are familiar with the system hardware, software and accessories.
- B. This contractor shall provide 18 hours of instruction to the owner's designated personnel on the operation of the TCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to: the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation. Contractor to provide local training facility that will accommodate up to 20 San Diego Housing Commission employees.
- C. The training shall be in three 6-Hour sessions as follows:
 - 1. First Training Session: 6-Hours of classroom training after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize them selves with the system before classroom instruction begins.
 - 2. Second Training Session: 6-Hours of classroom training approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
 - 3. Third Training Session: 6-Hours of classroom training to be scheduled at the request of the owner during the first six-month period. These sessions shall cover topics as requested by the owner such as: how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

PART 4 - SEQUENCES OF OPERATION

4.1 SEQUENCE OF OPERATION:

- A. Constant Volume Air Handling Unit, 1-Stage Cooling, 1-Stage Heating, with Economizer Enabled from Outside Air Dry Bulb Temperature.

Constant Volume HVAC Unit Controller Software. The constant volume unit controller shall be configurable for air handlers with staged or analog heating and cooling, minimum or modulating economizer outside or mixing damper dampers, and dry bulb economizer changeover. Controller shall comply with LonMark HVAC profile #8030.

- 1. Fan Off. Anytime the fan is off, all system heating and cooling shall be off, and the mixing dampers shall be positioned closed to the outside air.

2. Fan and Mode Control. System fan and heating/cooling temperature setpoints shall normally be placed in the occupied, standby, or unoccupied mode of operation and control via a system scheduler unique seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped up to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the outside air damper shall be closed and the fan shall remain off until heating or cooling is demanded to satisfy the unoccupied and standby temperature setpoints. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints a degree or two away from the occupied comfort settings.

System shall automatically revert to the proper mode of operation after restoration of power after a power failure. Units shall restart at a random staggered time interval after power restoration.

3. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each room temperature sensor wall module schedule override button shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).
4. Fan Fail Alarm. Any time the fan is commanded on and the fan differential pressure switch piped across the fan, or a fan current sensor, does not prove air flow or fan operation, a fan-failed alarm shall be presented to the operator station. This alarm check shall be delayed upon fan start for 10 seconds (adjustable) to give the system time to prove flow prior to creating a false alarm.
5. Temperature Control, Occupied Periods. Heating control shall operate with 6 cycles per hour, and cooling control shall operate with 4 cycles per hour unless the equipment manufacturer dictates other parameters. If the scheduler commands the fan to stop during periods of electric duct heating, the heater shall be de-energized and the fan shall continue to run for 60 seconds to dissipate the residual heater heat prior to stopping airflow. A staging PID algorithm with heating and cooling anticipation features shall be employed for all staging control. Upon a drop in space temperature below the heating setpoint, the lead duct heater shall be energized, the on time proportional to the heating load. After the lead heater stage becomes full on, a further increase in the heating load shall cause the lag heating stage to be cycled, the on time proportional to the increasing load. The reverse of this shall happen on a decrease in heating load. Upon a rise in space temperature above the cooling setpoint, the lead compressor/coil shall be energized, the on time proportional to the cooling load. After the lead cooling stage becomes full on, a further increase in the cooling load shall cause the lag compressor/coil stage to be cycled, the on time proportional to the increasing load. The reverse of this shall happen on a decrease in cooling load.

If the space temperature drops or rises to either the heating or cooling unoccupied temperature setpoint during unoccupied periods, the system shall start and operate in the heating or cooling mode until the unoccupied temperature setpoints have been satisfied. The same operation shall occur for the standby mode of operation where specified.

Discharge Low Limit. If at any time the discharge airdrops below the user defined discharge air temperature low limit, an alarm shall be issued and the mixing dampers shall be driven closed to the outside air. As the temperature rises, the dampers shall modulate open to the minimum ventilation position and the alarm shall clear.

6. Wall Sensor Module. Wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment knob (where specified), and a jack for connecting to the LonTalk communication network. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment knob on the wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by rotating the setpoint knob. The setpoint knob shall not affect Setpoints in use when the room is unoccupied.

4.2 VARIABLE AIR VOLUME AIR HANDLING SYSTEMS:

- A. System on/off status shall be based on schedule programmed into FMCS system.
- B. Failure of system to start based on supply fan motor current sensor shall signal alarm.
- C. Activation of duct smoke detector shall shut down system signal local control panel alarm and signal fire alarm system.
- D. Manual reset pressure switches shall automatically shut down system and send alarm signal whenever a high suction or high discharge pressure condition occurs such as that caused by damper closure.
- E. Minimum outside air damper and economizer outside air dampers shall close and recirculation damper shall open whenever system shuts down.
- F. Upon activation manual reset freezestat shall close outside exhaust air dampers, open recirculation damper, stop supply fan and signal alarm.
- G. Duct static pressure sensor (located near end of supply duct main) shall modulate AHU supply fan via variable frequency drive to maintain setpoint (adj.).
- H. Building static pressure controller shall modulate AHU return fan via variable frequency drive to maintain 0.05" (adj.) positive building static pressure based on sensed differential pressure between lowest pressure sensed at either first or second floor and building exterior.
- I. Upon receiving signal from fire alarm system, AHU shall shut down. FMS contractor shall provide contacts for receiving signal at AHU control panel and subsequent control wiring devices necessary to shut down system.
- J. Summer Occupied Operation:
 1. AHU fans operate continuously.
 2. Intake and exhaust dampers shall remain at minimum position.
 3. Discharge temperature sensor shall operate chilled water valve to maintain setpoint.
 4. Humidifier control valve shall be positively closed.

K. Summer Unoccupied Operation:

1. Fans shall be off.

L. Winter Occupied Operation:

1. Upon start-up, outside air, exhaust air and recirculation dampers shall move to their minimum position.
2. Discharge air temperature sensor shall modulate hot water control valve and dampers beyond minimum position in non-overlapping sequence to maintain setpoint.
3. If space temperature, as sensed by return air temperature sensor falls below 68 ° F. There shall be an automatic override where return dampers maintain minimum position, signal all system VAV boxes to move to 100% open, and modulate hot water coil valve until such time as return air temperature rises to 75 ° F. At this time, supply air discharge stat shall again assume control as specified previously. This shall also act as a "warm-up" cycle.

M. Winter Unoccupied Operation:

1. Fans shall be off.
2. If system room thermostats sense a temperature below the night setback temperature setpoint, system shall start in "warm-up" cycle until such time as thermostat is satisfied.

N. Input/Output Schedule (Minimum Points Required):

1. Supply fan start/stop	Digital Output (DO)
2. Return fan start/stop	DO
3. Supply fan status	Digital Input (DI)
4. Return fan status	DI
5. High static limit	DI
6. Smoke detectors	DI
7. Filter alarm	DI
8. Supply fan variable frequency drive (VFD)	Analog Output (AO)
9. Return fan variable frequency drive (VFD)	AO
10. Cooling coil valve	AO
11. OA/RA/EA Dampers	AO
12. Supply duct static pressure	Analog Input (AI)
13. Supply fan air flow	AI
14. Supply discharge temperature	AI

15. Building static pressure	AI
16. Return fan air flow	AI
17. Return air temperature	AI
18. Mixed air temperature	AI
19. Outside air temperature	AI

4.3 VARIABLE AIR VOLUME (VAV) BOXES:

A. VAV Box, Cooling Only, Pressure Independent:

1. Temperature Control. Zone temperature cooling setpoint shall normally be placed in the occupied, standby, or unoccupied mode of operation and control via a system scheduler unique seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped down to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the unoccupied and standby temperature setpoints shall be maintained. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints a degree or two away from the occupied comfort settings.
2. VAV box controls shall be enabled anytime the respective VAV AHU fan operates. Each VAV box shall have unique design minimum and maximum primary air cfm setpoints. As the cooling load varies a PID algorithm shall reset the box cfm setpoint between these min and max values to maintain the setpoint. An AIA algorithm shall modulate the box damper to maintain the cfm setpoint.
3. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each temperature sensor wall module (where specified) shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the wall module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).
4. Wall Sensor Module. Wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment knob (where specified), and a jack for connecting to the LonWorks communication network. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment knob on the wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by rotating the setpoint knob. Setpoints in use when the room is unoccupied shall not be affected by the setpoint knob.
5. Input/Output Schedule (Minimum Points Required):

- | | |
|--|--------------------|
| a. VAV box space temperature (each) | Analog Input (AI) |
| b. VAV box space temperature setpoint (each) | AI |
| c. VAV box primary air CFM (each) | AI |
| d. VAV box damper position (each) | Analog Output (AO) |

B. VAV Box, Cooling & Hot Water Heat, Pressure Independent

1. Temperature Control. Zone temperature setpoints shall normally be placed in the occupied, standby, or unoccupied mode of operation and control via a system scheduler unique seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped up or down to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the unoccupied and standby heating and cooling temperature setpoints shall be maintained. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints a degree or two away from the occupied comfort settings.

VAV box controls shall be enabled anytime the respective VAV AHU fan operates. Each VAV box shall have unique design minimum and maximum primary air cfm setpoints. As the cooling load varies a PID algorithm shall reset the box cfm setpoint between these min and max values to maintain the setpoint. An AIA algorithm shall modulate the box damper to maintain the cfm setpoint.

As the zone temperature drops to the heating setpoint, the box shall maintain the minimum cfm setpoint and modulate the hot water valve via a PID algorithm to maintain the heating setpoint.

The BMCS operator shall have displays of the space temperature, the primary air cfm, the box damper position, and the hot water valve position. The operator shall have displays and modification ability of the six temperature setpoints and the two cfm setpoints.

2. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each temperature sensor LCD wall module shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the LCD wall module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).
3. LCD Wall Sensor Module. LCD wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment keys. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment on the LCD wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by pressing the setpoint up and down keys. Setpoints in use when the room is unoccupied shall not be affected by the local setpoint.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions and Division 1 are part of this section and the contract for this work and apply to this section as fully as if repeated herein. This section, 16050, applies to all Division 16 categories.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 EXPLANATION OF DRAWINGS

- A. These construction documents are intended to be diagrammatic and reflect the scope, quality, and character of the work to be performed; all miscellaneous materials and work required for a complete and operational system, though not specifically mentioned, shall be furnished and installed by the Contractor.
- B. The Contractor shall confirm sizes, dimensions, weights and locations of all devices, light fixtures, and equipment prior to installation. Dimensioned architectural drawings shall take precedence over diagrammatic layouts shown on these contract documents.
- C. The specifications and the drawings are an integral document and shall be considered complementary to each other. In the case of a conflict between the specifications and the drawings, the more constricting condition shall be enforced.
- D. The Contractor shall be responsible for reporting any discrepancies, errors, or omissions noted prior to bid.
- E. It is the intent of the drawings to indicate schematic routing and placement of devices, fixtures, equipment and conduit. Equipment or devices requiring a precise location shall be dimensioned on other trade documents (architectural, mechanical, etc.). Offsets, elbows, or extensions shall be furnished and installed by the Contractor as necessary to avoid structure, piping, and clearances and to provide a complete and workmanlike installation.

1.03 QUALITY ASSURANCE

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications and supplements, of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)

6. Local Code Enforcement Agency Requirements
7. National Electrical Code (NEC)
8. National Electrical Contractor's Association (NECA)
9. National Electrical Manufacturer's Association (NEMA)
10. National Electrical Testing Association (NETA)
11. National Fire Protection Association (NFPA)
12. Underwriters' Laboratories, Inc. (UL)
13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the Contractor.

1.04 SUBMITTALS

- A. Shop drawings for materials, equipment, devices, fixtures, and systems shall be submitted by the Contractor for review within 30 days after award of the contract. In addition to the requirements for submittals stated herein, the Contractor shall be responsible for compliance with the requirements of Division 1.
- B. The Contractor shall bear the responsibility for any materials installed which were not submitted for review or not installed in compliance with the review comments and the contract documents.
- C. Verbal modification of submittal documents or changes to the requirements of the contract documents shall not be acceptable. All submittal material must be documented in a written format.
- D. All submittal packages must be submitted at one time and in accordance with the specification section appropriate for the material. All packages must be identical and clearly labeled indicating the specification section, project name, submittal date, Contractor's name, Engineer's name, preparer's name and submission version (first submission, resubmittal #1, etc.).
- E. Product catalog cutsheets and descriptive literature shall be cross-referenced to the specification section by paragraph.
- F. All submittal packages shall be permanently bound in brochure or booklet format. A minimum quantity of six (6) submittal booklets shall be provided by the Contractor; additional copies may be required if so noted.
- G. Materials which bear a certification or approval of a testing agency, performance criteria, society, agency, of other organization shall be submitted with all labels identified.

- H. The submittal shall be complete and with catalog data and information properly marked to show, among other things, materials, capacity and performance data to meet the specified requirements.
- I. Incomplete submittals will be rejected at the discretion of the reviewing Engineer.
- J. Review of the submittal is only for general conformance with the contract documents. The Contractor is responsible for confirmation and coordination of dimensions, quantities, sizes, fabrication, installation methods, and for coordination of work of other trades with electrical work.
- K. Detailed working drawings shall be prepared and submitted showing items which are to be fabricated including transformer mounting racks, unistrut mounting frames, equipment room layouts, pull boxes, splice boxes, gutters, etc.
- L. Minimum scale for submitted drawings shall be 1/8". Details shall be drawn to 1/4" scale. All drawings shall be 8.5"x11" or larger.
- M. Submittal brochures shall be complete and descriptive of the type, make, manufacturer, application, quantity, performance, capacity, ratings, options, dimensions, clearances, weights, nameplate data, special installation requirements, mounting method, NEMA type, NEMA class, environmental restrictions, layout requirements or other information as may be necessary for review of the material.
- N. Submittal brochures for switchgear shall include, as a minimum, the following: singleline diagrams; fault current ratings of buses and devices; device identification, ratings, layout and characteristics; dimensions; circuit identification; identification label type and method of affixing; mounting; conduit entry point and quantities; NEMA enclosure type; and additional data as required for a complete review.
- O. Submittal brochures for lighting systems shall include, as a minimum, the following: manufacturer; detailed drawing or photograph; dimensions; lamp data; ballast data; certified photometric data from a third-party testing agency; U.L. label listing; fixture number or identification from the drawings; finish color and material; mounting equipment; socket type and rating; environmental ratings (damp location, watertight, explosion-proof, etc.); voltage; input wattage; and additional information as necessary for a complete review.
- P. The Contractor shall be responsible for all aspects of substitutions of material including any additional cost or delay incurred as a result of the substitution. The Contractor shall coordinate all substitutions with other trades, verify code compliance, verify clearances, photometric performance, appearance, suitability, constructability, and availability of the material prior to submitting the substitution for review. The Contractor shall bear the responsibility of any increased costs to other trades which are directly related to the substitution.

1.05 MATERIAL HANDLING

- A. The Contractor shall deliver all equipment and material to the site in the manufacturer's original packaging without seals broken.
- B. The Contractor shall handle, store, protect, and unpack all equipment and materials in accordance with the manufacturer's recommendations.
- C. The Contractor shall inspect the equipment and materials in a timely manner to ensure the completeness and appropriateness of the shipment.

- D. The Contractor shall immediately replace damaged or defective equipment or materials with identical new equipment or material at no cost, inconvenience, or delay to the Owner.

1.06 EXISTING CONDITIONS

- A. The Contractor shall verify all existing conditions prior to bid and include all costs associated with the existing conditions in bid.
- B. The Contractor shall match the finish and appearance of all existing conditions where constructing new work adjacent to existing surfaces or equipment.
- C. Coordinate with the Owner's Representative for all ongoing projects or the work of other trades which may affect the Contractor's work. Verify Owner schedule requirements for special or standard events which may impact the Contractor's work.
- D. Coordinate work to be performed in occupied areas and comply with the Owner's requirements such that the Owner's work or ongoing activities are not disrupted by the Contractor. Verify the need for work to be performed during premium hours, evenings, weekends, or holidays prior to bid and include all costs in bid. Bring to the Owner's attention the need and locations for all disruptive work prior to commencement of work.

1.07 UTILITY COMPANY REQUIREMENTS

- A. The contractor shall contact the serving utility company for all utility system requirements prior to commencement of work. Utility work shall include electric power, telephone, data, fiber optic cable, cable television or other utilities as may require connections as a part of this contract. Coordinate and comply with all serving utility company requirements, designs, and schedules.
- B. The utility information depicted on the contract documents is for bidding purposes only and shall not be used for construction purposes. All construction shall be performed according to engineered documents provided by the serving utility company. The Contractor shall obtain and coordinate with utility company requirements as a part of this contract and furnish and install all work as a part of this contract.
- C. Verify all connection points, routing, and requirements with the serving utility company prior to commencement of work and coordinate final requirements with other trades.
- D. The Contractor shall be responsible for all costs associated with failure to contact or coordinate with utility company requirements.

1.08 TEMPORARY CONSTRUCTION UTILITY REQUIREMENTS

- A. Power, telephone or other temporary construction utility services required by the Contractor shall be the responsibility of the Contractor.
- B. Arrangements for temporary construction utility services shall be made by the Contractor in coordination with the Owner's Representative and the serving utility company.

1.09 CONTINUITY OF SERVICE

- A. The Contractor shall coordinate all shutdowns, outages, and service interruptions with the Owner's Representative. Electrical shutdowns shall be kept to the minimum number necessary to complete the work.
- B. The Contractor shall coordinate all work done on overtime or premium time with Owner's Representative prior to commencement of work.

- C. All work performed in or through occupied spaces, or other work disruptive to existing occupants shall be considered as performed during premium time or as overtime for the purposes of the bid; include all costs in bid.
- D. The Contractor shall notify Owner's Representative of all shutdowns or disruptive work a minimum of 72 hours prior to commencement of work. The Contractor shall obtain written approval from the Owner's Representative prior to commencement of work.
- E. The Contractor shall provide all necessary temporary power, including temporary power generation, to accommodate shutdowns and minimize disruption of the Owner's activities.
- F. The Owner reserves the right to provide emergency repairs or temporary power to maintain service continuity at the Contractor's cost in the event Contractor fails to provide adequate service continuity.

1.10 RECORD DOCUMENTS

- A. The Contractor shall prepare as-built documents depicting all revisions to branch circuits, conduit routing, equipment, panel schedules, lighting control schedules, or materials. Drawings shall be in AutoCAD .dwg format and Adobe .pdf formats. Contractor shall provide (1) full-size hard copy print and (1) CD-ROM of all as-built drawings and files. Hand-drawn or "red-line" drawings shall not be accepted. Drawings shall be legible, reproducible, and properly identified such they may be used as a reference for maintenance or construction.
- B. The Contractor shall provide a minimum of three copies of the operation and maintenance manuals to the Owner's Representative at the completion of the project. Each copy shall be bound in a three-ring binder and labeled indicating: the project name; system name; Contractor's name, telephone number, and contact person; and Owner's name. The Contractor shall provide the following minimum information within each manual:
 - 1. List of the Subcontractors performing work on the system including contact names, telephone numbers, and email addresses.
 - 2. Routine and emergency service contact names, telephone numbers, and email addresses for each system.
 - 3. Description of system operation.
 - 4. Single line diagrams and control wiring diagrams.
 - 5. Detailed product literature with technical information.
 - 6. Local factory representative contact name, telephone number, and email address.
 - 7. Sequence of starting, shutdown and operation.
 - 8. Installation instructions and safety requirements.
 - 9. Maintenance schedule, testing instructions and performance parameters.
 - 10. Parts list including recommended spare parts.

1.11 GUARANTEE

- A. All electrical work, materials and equipment provided under this contract shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner. Any failures, problems, or deficiencies experienced during this period due to defective materials or faulty workmanship shall be immediately corrected by the Contractor without cost to the Owner. The Contractor shall be responsible for all damages to the Owner's facility, production, or work product due to deficiencies in the electrical system. Equipment guarantees in excess of one year shall not be superseded by this guarantee.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall be new, of prime quality, listed as suitable for the application, and bear factory-applied U.L. labels.
- B. Materials shall be currently in production and shall be supported by spare parts, repair service, maintenance, and factory technical support.
- C. Materials of one assembly (switchboards, substations, motor control centers, etc.) shall be of one manufacturer unless specifically stated otherwise in the contract documents.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. All work shall conform to National Electrical Contractors Association standards of installation and the requirements of the manufacturer, Division 1, Division 16, and the Owner's Representative.
- B. The Contractor shall field-verify all dimensions and coordinate dimensions with equipment sizes and locations.
- C. The Contractor shall coordinate and install all penetrations, openings, slots, chases, or sleeves as necessary for the routing and installation of raceways, conductors, or equipment. The Contractor shall provide approved fire sealant to maintain fire ratings at all penetrations.
- D. The Contractor shall coordinate the placement and sequence of installation of all mounting bolts, conduits, sleeves, etc. which are to be set in poured-in-place concrete slabs, concrete walls, and post-tension slabs per the structural drawings.
- E. The Contractor shall install access panels in walls or ceilings in coordination with the Architect for all junction boxes or electrical equipment which require access.
- F. All equipment shall be installed plumb, parallel, or orthogonal to structure and in a neat orderly fashion. All material shall be accessible for maintenance, inspection, servicing or replacement.
- G. Verify final locations of devices, equipment, and fixtures during the rough-in phase with dimensioned architectural drawings, fabrication drawings, or other space planning requirements included in the contract documents.
- H. The Contractor shall coordinate and arrange for the proper sequence of construction including scheduling of long-lead items, shutdowns, work of other trades, and Owner-scheduled events.
- I. The Contractor shall provide adequate and qualified supervision for the work performed; no work shall be performed without the supervision of a representative of the Contractor.
- J. The Contractor shall coordinate and cooperate with all other trades for a successful completion of the project.

3.02 SEISMIC BRACING

- A. The Contractor shall seismically brace all equipment in accordance with requirements of the California Code of Regulations, Title 24, Seismic Design Category D and provide certification of seismic compliance upon request, including structural calculations as required.

3.03 CUTTING AND PATCHING

- A. The Contractor shall provide cutting and patching as required to install the electrical system in this contract.
- B. Coordinate the schedule of all cutting such that the work may be performed in an expeditious manner with minimum inconvenience to the Owner.
- C. Remove or cut structures or materials as necessary for demolition prior to the installation of new electrical work.
- D. The Contractor shall protect all surfaces, structure, furnishings, and finishes not directly affected by cutting or patching.
- E. Provide dust and moisture barriers as required during cutting and prior to patching openings.
- F. All penetrations through roofs shall be performed per architectural requirements, including compliance with the roofing manufacturers requirements.
- G. Patching shall be performed with materials which exactly match the adjacent surfaces in color, texture, character, and appearance.
- H. All patches must maintain the fire ratings of the original surface and shall be sealed with a U.L. listed and Fire Marshal approved sealant.

3.04 COMMISSIONING

- A. The Contractor shall initiate start up of all electrical equipment including operation of all devices, switches, generators, transfer switches, overcurrent protection, disconnect switches, etc. to verify normal operation of all moving parts and electrical performance.
- B. The Contractor shall test, adjust, aim, align, label, clean and complete all systems prior to acceptance by the Owner's Representative.
- C. The Contractor shall demonstrate that all systems operate within the manufacturer's recommended performance characteristics, the electrical construction documents, system requirements, and Owner requirements.
- D. The Contractor shall test each system per the manufacturer's requirements and shall perform the following system tests:
 - 1. Inspect cables for physical damage and proper connection.
 - 2. Torque test cable connection and tighten in accordance with termination manufacturers recommendations.
 - 3. Infrared scan all connections under loaded conditions and provided color printed images.
 - 4. Insulation resistance test of each cable.
 - 5. Inspect ground system connections.
 - 6. Voltage drop tests on the main grounding electrode of system.
 - 7. Determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral points.
 - 8. Check rated voltage and phase balance at all equipment, motors and selected devices at full load conditions. Measure no load voltage conditions at each location.
 - 9. Furnish all material, equipment, instruments and labor as required to complete testing.
 - 10. Provide all test results properly bound in a three-ring binder.

3.05 TRAINING

- A. Furnish at least one copy operating instructions from the manufacturer for all electrical equipment to the Owner's Representative. Instructions shall be clean, legible, and properly bound in a three-ring binder.
- B. The Contractor shall provide training for the Owner's staff as directed by the Owner's Representative for a minimum of one man-day (eight hours).
- C. Provide classroom training by a qualified instructor for the operation, installation, and maintenance of designated equipment or systems including, but not limited to, generation systems, transfer switches, uninterruptible power supplies, energy management systems, lighting control systems, power distributions systems, and other systems which may require instruction.

3.06 CLEANING

- A. Contractor shall clean all equipment, panelboard interiors, conduit interiors, fixtures, devices, etc. of all extraneous paint, drywall mud, overspray, dust, dirt, debris, trash, grease or markings. All cleaning shall be performed by the Contractor in accordance with the appropriate manufacturer's recommendations.

END OF SECTION

SECTION 16073

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

- A. Submit shop drawings per Section 16050 for review including the following:
1. Support materials
 2. Attachment and anchor materials
 3. Installation materials and methods

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Thomas & Betts Corporation.
 - c. Unistrut; Tyco International, Ltd.
 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following and shall be compatible with all building surfaces and materials:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- i. Hilti Inc.
 - ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - i. Hilti Inc.
 - ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and GRC as required by the NEC. Minimum rod size shall be 3/8 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

- A. Submit shop drawings per Section 16050 for review including the following:
 - 1. Raceway materials
 - 2. Fitting materials
 - 3. Installation materials and methods

PART 2 - PRODUCTS

2.01 RIGID GALVANIZED STEEL (RGS) CONDUIT

- A. Continuous hot-dipped galvanized manufactured per UL and ANSI requirement.
- B. Rigid aluminum conduit is not acceptable.
- C. Conduit bodies for use with steel conduit, rigid or flexible, shall be manufactured per UL requirements and shall be cast metal with gasketed closures.
- D. Fittings for RGS conduit shall be malleable iron or forged steel with cadmium or zinc coating.
- E. Union couplings for joining rigid conduit at intermediate runs shall be of the same material as the conduit. Couplings shall be threaded concrete-tight to permit completing conduit runs when neither conduit can be turned and to permit breaking the conduit run at the union.
- F. Set screw connectors or threadless type are not acceptable.
- G. Minimum raceway size shall not be less than ¾".

2.02 ELECTRICAL METALLIC TUBING (EMT)

- A. Conduit shall be cold rolled zinc coated steel and manufactured per UL and ANSI requirements.
- B. Fittings for EMT shall be watertight steel or malleable gripping ring compression type.
- C. Pressure cast material for nuts of compression ring type fittings and set-screw connections are not acceptable.
- D. Minimum raceway size shall be ¾".

2.03 ELECTRICAL NON-METALLIC TUBING (ENT)

- A. Conduit shall be manufactured in accordance with NEMA TC13 standards and shall be UL listed.
- B. Fittings for ENT shall be snap-on type threaded male adapters and locknuts.
- C. Minimum raceway size shall be ¾".

2.04 FLEXIBLE METALLIC CONDUIT

- A. Flexible conduit shall bear the UL label and be zinc coated steel.
- B. Fittings for flexible metallic conduit shall be steel or malleable iron. Fittings shall clamp to conduit securely.
- C. Screw in type, sheet metal or set-screw type fittings are not acceptable.

- D. Minimum raceway size shall not be less than ¾".

2.05 LIQUID TIGHT FLEXIBLE CONDUIT

- A. Conduit shall be manufactured in accordance with UL and ANSI requirements. Conduit shall be approved for grounding and compatible with approved fittings. Flexible steel conduit shall be hot dipped galvanized with extruded PVC covering manufactured per UL requirements.
- B. Fittings shall be liquid tight type with body and gland nut of steel or malleable iron with provisions for grounding flexible conduit to fittings.
- C. Minimum raceway size shall be ¾".

PART 3 - EXECUTION

3.01 RIGID GALVANIZED STEEL (RGS) CONDUIT

- A. RGS shall be used where exposed to weather or where subject to physical damage in exposed areas below 8'0" above finished floor.
- B. RGS shall be used in NEC classified hazardous locations with seal connections per NEC requirements.

3.02 ELECTRICAL METALLIC TUBING (EMT)

- A. EMT shall be run indoors concealed in drywall type construction, above suspended ceilings, and exposed indoors not less than 8'0" above finished floor in unfinished areas.
- B. EMT shall not be installed underground, outdoors, or embedded in concrete.

3.03 ELECTRICAL NON-METALLIC TUBING (ENT)

- A. ENT shall be run indoors concealed in drywall type construction where permissible by Code and by the local authority. ENT shall not be installed in any exposed areas.
- B. ENT to be installed embedded in concrete shall be approved by the Structural Engineer prior to installation. All embedded installations shall comply with the installation requirements provided by the Structural Engineer.

3.04 FLEXIBLE METALLIC CONDUIT

- A. Flexible conduit shall be used for indoor lighting connections in suspended ceiling areas and shall not exceed 6'0" in length.
- B. Flexible conduit shall be used for final connection to control equipment and not to exceed 2'0" in length.
- C. The conduit grounding system shall be continuous as recommended by the manufacturer and UL approved.

3.05 LIQUID TIGHT FLEXIBLE CONDUIT

- A. Liquid tight flexible conduit shall be used for final connection to machines, motors, transformers and equipment that requires vibration isolation.
- B. Liquid tight flexible conduit shall be used for final connection to equipment in wet or damp locations or where exposed to grease, water, dust, dirt, vapors, or chemicals.

- C. The conduit grounding system shall be continuous as recommended by the manufacturer and UL requirements.

3.06 CONDUIT INSTALLATION

- A. All conduit installation methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- B. All conduit installations shall comply with the manufacturer's installation requirements.
- C. All spare conduit shall be cleaned, mandrelled, and provided with a pullwire.

END OF SECTION

SECTION 16120

WIRE AND CABLE

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriter's Laboratories, Inc.(UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

A. Submit shop drawings per Section 16050 for review including the following:

1. Conductor materials and stranding
2. Connector and termination materials
3. Installation materials and methods
4. Termination materials and methods

PART 2 - PRODUCTS

- 2.01 Conductors shall be copper; conductors size #12AWG and smaller shall be solid, conductors size #10AWG and larger shall be stranded. Conductors shall be minimum size #12AWG for power and lighting circuits; control circuits shall use a minimum conductor size of #14AWG.
- 2.02 Insulation shall be type THW or THHN/THWN for all branch circuits up to and including size #2AWG. Insulation for conductors over size #2AWG shall be XHHW.
- 2.03 Jackets shall be nylon or PVC material.
- 2.04 All cables shall be UL listed for the application.
- 2.05 All conductors shall be installed in conduit in the field, unless specifically noted otherwise in these documents. Type AC and type NM cable is not acceptable; type MC cable may be used where specifically noted for purposes of flexibility, maintenance, or ease of installation but shall not be used without explicit permission and direction of the Engineer.
- 2.06 Multi-conductor flexible cords shall be types SO, SJO, STO, or SJTO.
- 2.07 Electrical connectors shall be UL listed and suitable for the conductor material being connected and rated appropriately. Connectors shall be solderless helical metal spring pressure type or solderless finger metal spring barb type for conductors #10AWG and smaller. Connectors shall be compression type for conductors #8AWG and larger.

PART 3 - EXECUTION

- 3.01 All wiring methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.02 Conductors shall be installed in clean raceways using nylon cord, polypropylene cord, hemp rope, or other material which will not damage the conductors or conduit. Do not use metal fish tape to pull conductors. Use a listed cable pulling lubricant when necessary for pulling.
- 3.03 Conductors shall be pulled into conduit simultaneously so as to not damage conductors during pulling.
- 3.04 Conductors installed at outlets and switches shall have a minimum of 6" pigtail left in the box for future connections. All conductors not connected to devices shall be terminated with splice caps and tape.
- 3.05 Conductors shall be terminated such that no copper material is exposed. Conductors shall be trained and labeled at terminations in a neat and workmanlike manner.
- 3.06 All terminations shall be mechanically sound, featuring helical twisting of the terminating conductors prior to the application of an electrical connector. The electrical connector shall not be used for the mechanical connection of the conductors.
- 3.07 All terminations shall comply with the manufacturer's installation and torquing requirements.
- 3.08 Splices on conductors #10AWG and smaller shall be made with splice caps twisted onto the

conductors. Tape all splices.

- 3.09 Splices on conductors #8AWG and larger shall be made with pressure connectors and terminal lugs. Where exposed to water, damp air, or moisture splices shall be watertight.
- 3.10 Splices shall be not be made in feeders; splices to branch circuits shall not be made within panelboards or similar enclosures.
- 3.11 When combining homeruns, the Contractor shall derate all conductors per NEC requirements including reducing the conductor ampacity and using high temperature insulation where necessary. Conduit sizes shall be adjusted by the Contractor, per NEC requirements, for any conductor revisions.
- 3.12 The Contractor shall provide a code-sized insulated grounding conductor, in addition to the feeder conductors indicated on the drawings, for all feeder circuits.
- 3.13 Conductors shall be color-coded as follows:

208Y/120V	Phase	480Y/277V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

3.14

Where tape or labels are used for color-coding, apply material at each end of the conductor, at all splices, within all boxes, and at all terminations.

END OF SECTION

SECTION 16125

MODULAR WIRING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes modular wiring distribution system, including:
 - 1. Zone Distribution Box.
 - 2. Extender Cables.
 - 3. Splitters.
 - 4. Access Floor Boxes.
 - 5. Wall boxes.
- B. Related Sections:
 - 1. Access flooring is specified in Section 10270.
 - 2. Electrical is specified in Division 16.

1.02 SYSTEM DESCRIPTION

- A. Modular power system shall ensure efficient electrification and delivery of power from a zone distribution box to access floor boxes or wall boxes at any location. The system shall be prefabricated to a pre-determined configuration but will also allow for field modification of the zone distribution without voiding the UL listing. The zone distribution boxes will have total flexibility by not being pre-designated to specific floor plan locations. Homerun cabling will be supplied and connected to the zone distribution box by a local licensed contractor. Additional field installed homeruns can be added as well as additional whips and terminal blocks, with a maximum capacity of 16 circuits per zone box. System shall be designed and approved for use below raised access floor systems and above drop ceiling spaces.
- B. Modular wiring system is based on zone wiring requirements. Power distribution is achieved above or below ceiling or access floor through use of extender cables from the zone distribution box. Homerun cabling is provided by the local contractor at distribution. This method of wiring eliminates the need for any additional distribution modules. Access floor boxes or wall boxes are connected to the zone boxes by way of extender cables and splitters. In order to maximize flexibility floor boxes and wall boxes must be able to be removed and or added without impacting the use of existing modules downstream (also known as daisy chaining).
- C. Modular connectors shall accommodate up to 8 conductors and employ following safety features:
 - 1. Connectors shall have a positive metal lock clip and incorporate polarity keys to prevent interconnection of 3 and 4 circuit components.
 - 2. Plastic clamshell case connector.
 - a. UL flammability rating of 94V0.
 - b. Gendered and keyed to prevent possible mismatching of dissimilar voltages.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including installation instructions.
- B. Project Record Documents: Submit project record documents, including as-built drawings and wiring diagrams.
- C. Warranty: Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

- A. Modular Wiring System:
 - 1. Electrical Distribution System: UL Listed as Manufactured Wiring System, compliant with UL 183.
 - 2. Compliant with grounding and shielding requirements of TIA/EIA 568-A and 569-A and National Electrical Code, Article 800-52(a).
 - 3. UL listing shall allow for 3-phase, 120/208 volts and/or 1-phase, 120/240 volts, 50 Hz or 60 Hz power distribution, 20 amps.
 - 4. Multi-Outlet Assembly: Compliant with National Electrical Code, Article 353.
 - 5. Manufactured Wiring System: Compliant with National Electrical Code, Article 604.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened, protective containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in secure, clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage and moisture during handling and installation.

1.06 WARRANTY

- A. Modular Wiring System: Warranted to be free from defects in material and workmanship for period of 5-years. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Spider Agile Technology or approved equal.

2.02 MODULAR WIRING SYSTEM - DISTRIBUTION

- A. Spider Zone Distribution System:
 - 1. ZDB – 4 whip or 2 whip
 - 2. Ports: 2 homerun in and 6 whip out maximum.
 - 3. Circuits of General Purpose and Isolated Power Distribution: 16 maximum.
 - 4. Connect to Circuit Breaker: Homerun supplied by others

5. Construction:

- a. Material: Galvanized steel with 1/2- and 3/4-inch knockouts
- b. Minimum Thickness: 16-gauge
- c. 1-3/4-inch thick to fit under most low profile access floors
- d. Up to 4 DIN rail mount terminal blocks (typical 2) for field modification capability
- e. Removable lid for in field access
- f. Have four steel standoff post to provide additional support to the lid
- g. Whips shall be of Extra Flex to provide maximum bend radius
- h. Whips are secured to the zone box with an electrical conduit fitting for superior strain relief.
- i. Face mounted terminal connectors are not acceptable.
- j. Whips shall have circuit wiring diagram label
- k. Circuit labels on the inside and outside of the box and lid.

B. Access Floor Boxes:

1. AFB:

- a. Low profile 2-1/2-inch deep 4 gang w/ reversible metal lid
- b. 3-inch deep 4 gang w/ reversible metal lid
- c. 5-inch deep 8 gang w/ reversible metal lid
- d. 16-gauge galvanized steel
- e. Quick-in installation tab screws

2. AFB101:

- a. 6-inch deep 4 gang w/ reversible polycarbonate lid
- b. Lid opens 180° and lays flat
- c. 16-gauge galvanized steel
- d. Quick-in installation tab screws

3. RAFB:

- a. Round access floor box 7-7/8-inch diameter
- b. 6-inch deep 4 gang with metal lid
- c. Lid opens 180° and lays flat
- d. 16-gauge galvanized steel

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- e. Quick-in installation tab screws
- C. Extender Cables:
 - 1. 20 Amp 120/208v 60Hz
 - 2. 9/16" Ultra Flex Armored cable
 - 3. Quick connect ends have polarity keys to prevent interconnection of 3 and 4 circuit components
 - 4. Lengths in 5-foot increments to 50-feet
- D. Splitter (Circuit Distributors):
 - 1. 20 Amp 120/208V 60Hz
 - 2. 4 port devise (1 male port receives circuits / 3 male ports distribute circuits out)
 - 3. Circuit distributors incorporate polarity keys to prevent interconnection of 3 and 4 circuit components
- E. Pre-Wired Drywall Boxes:
 - 1. 16-gauge galvanized steel
 - 2. Barriers available to provide separation between power and low voltage
 - 3. Combination knockouts support various cable fill requirements
 - 4. Adjustable stud mounting bracket for 1/2-inch, 5/8-inch, 1-inch and 1-1/4-inch wallboard.
 - 5. Available in 1, 2 4 or 6 gang
 - 6. Snap in or screw type face plates.
 - 7. Pre-wired with (typical) 20-foot 9/16-inch Ultra Flex cable with pigtail end.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive modular wiring system. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install modular wiring system in accordance with manufacturer's instructions, system design drawings, National Electrical Code, and local municipal codes as required.
- B. All outlets, boxes and enclosures shall be fastened securely to walls or permanent structures
- C. Verify power wires and data cables are separated by a physical barrier.
- D. Coordinate installation of modular wiring system with other work in progress.

END OF SECTION

SECTION 16130

BOXES

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriters' Laboratories, Inc. (UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.

- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

A. Submit shop drawings per Section 16050 for review including the following:

1. Box materials
2. Accessory materials

PART 2 - PRODUCTS

- 2.01 Boxes shall be flat rolled steel sized as required by code and as suitable for the application. Boxes shall have mounting holes and knock-outs in sides and back. Grounding shall be accommodated by means of threaded holes.
- 2.02 Provide accessories, extension rings, gaskets, supports, trim rings, hangers, straps, and other material as necessary for a complete code complying installation.
- 2.03 Boxes installed outdoors shall be weathertight, dusttight, and corrosion resistant. Provide gaskets and conduit hubs.
- 2.04 Provide type FS boxes for surface mounted applications.
- 2.05 Provide additional support for boxes as necessary when mounting fixtures or devices from boxes.
- 2.06 Provide ganged boxes for multiple switches and devices; provide barriers for boxes served by separate voltages.
- 2.07 Acceptable manufacturers shall be Appleton, Crouse Hinds, Steel City, or Raco.

PART 3 - EXECUTION

- 3.01 All box installation methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.02 Install all boxes plumb, square, and securely fastened to structure.
- 3.03 Boxes shall be placed such that they are readily accessible.
- 3.04 Cover or plug all unused openings in boxes where knockout blanks have been removed.
- 3.05 Install boxes such that they are flush with the finished surface of the wall or surface within which they are mounted.
- 3.06 Install all boxes at mounting heights per architectural plans, NEC requirements, and ADA requirements.
- 3.07 Boxes shall not be mounted back to back in walls. Minimum offset shall be 12".
- 3.08 Boxes in sealed environments shall be sealed with an approved sealant suitable for the application.
- 3.09 Boxes penetrating fire rated walls or surfaces shall be sealed with a Fire Marshal approved fire sealant to maintain the fire rating of the wall or surface.
- 3.10 Boxes located above inaccessible ceilings shall be made accessible by means of access doors or hatches in the ceiling.
- 3.11 Install all boxes per manufacturer's recommendations and requirements.
- 3.12 Provide for ground continuity at all boxes.

SECTION 16140

WIRING DEVICES AND CONNECTORS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

- A. Submit shop drawings per Section 16050 for review including the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Wiring devices
 - 4. Accessories

PART 2 - PRODUCTS

2.01 RECEPTACLES

- A. Wiring devices shall be UL listed and suitable for the application.
- B. Devices shall be color coded per the system to which they are connected: normal power shall be white; emergency power shall be red; dedicated outlets shall be grey; unless otherwise noted on the construction documents.
- C. Receptacles shall be heavy duty, screw type, side wired, 120V, 20A, duplex type, unless noted otherwise on the construction documents. Verify NEMA configuration with construction documents.
- D. Weathertight receptacles shall be gasketed in cast metal boxes with cast metal coverplates. Coverplates shall have spring-loaded in-use hinged covers.
- E. Ground fault interrupting receptacles shall be duplex type and capable of detecting a leaking current of 5mA.

2.02 TOGGLE SWITCHES

- A. Toggle wall switches shall be quiet AC type, rated 120/277V, 20A and UL listed for the application.
- B. Switches shall be single pole, double throw with white finish unless noted otherwise.

2.03 COVERPLATES

- A. Single, combination coverplates shall be used at all ganged device locations.
- B. Provide white plastic coverplates with white screws in all office areas. Provide stainless steel coverplates with matching screws in janitorial, mechanical, laboratory, process, manufacturing, and clean room areas or as noted on the construction documents. Provide weaterproof in-use covers for all exterior locations.
- C. Provide labeled plates as noted on the construction documents.
- D. Provide labeled plates at all receptacles with circuit and panel designation. Labeling method shall utilize clear adhesive printed labels with black bold letters.

2.04 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be Arrow Hart, Hubbell, Leviton, or Pass and Seymour.

PART 3 - EXECUTION

- 3.01 Installation method of wiring devices shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.

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- 3.02 Installation of receptacles in dwelling unit bedrooms shall comply with NEC section 210-12(b) and shall be protected by an arc fault circuit interrupter.
- 3.03 Install all devices in accordance with the manufacturer's recommendations and requirements.
- 3.04 Contractor shall verify installation orientation of duplex outlets (ground pin up or down) with Owner's representative prior to installation.
- 3.05 Coordinate device mounting height, location and type with architectural and interior drawings. Coordinate with other trades to identify conflicts with device locations and notify the Engineer of any conflicts.
- 3.06 Install devices only in clean boxes.
- 3.07 Install all trim rings and coverplates in coordination with other trades and their installation schedules.
- 3.08 Tighten and inspect all connections prior to covering devices and reconnect or repair wiring as necessary.
- 3.09 Test all devices for voltage level, continuity, ground fault, and short circuits.
- 3.10 Install all devices plumb and square to structure and adjacent surfaces.
- 3.11 Connect and inspect all ground bonds prior to covering device.
- 3.12 Demonstrate the proper operation of all ground fault interrupting devices.

END OF SECTION

SECTION 16150

GROUNDING AND BONDING

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 SCOPE

- A. Permanently and effectively ground conduit systems, supports, cabinets, switchboards, equipment cases, motor frames, lighting standards, landscape lighting, etc., and system neutral conductors per National Electrical Code.
- B. Grounding details, symbols and singlelines shown on plans are schematic only. If additional equipment, such as ground rods, clamps, conductors, etc., is required per National Electrical Code furnish and install without additional cost to Owner.

1.03 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of standards listed below form an integral part of this specification.
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriters' Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)
- B. Furnish products listed by Underwriters Laboratories, Inc. as suitable for purposes specified and shown.

1.04 SUBMITTALS

- A. Submit shop drawings per Section 16050 for review.
- B. Manufacturer's data on grounding and bonding products and associated accessories.

1.05 ACCEPTABLE MANUFACTURERS

- A. Burndy Corporation
- B. Cadweld Division
- C. Crouse-Hinds
- D. Thomas and Betts Corporation
- E. Okonite Company
- F. Tecto Weld

PART 2 - PRODUCTS

2.01 GROUNDING MATERIAL

- A. Rod Electrode: Material to be copper clad steel rod, 3/4 inch diameter with minimum 10 feet length.
- B. Mechanical Connectors: Material shall be copper and of sound continuity when installed.
- C. Exothermic Connectors: Material shall be of low emission, electric-start type and of sound continuity when installed.
- D. Bare Ground Conductors
 - 1. Conductor shall be 7-strand annealed copper.
 - 2. Individual members of stranded conductor shall meet the requirements of ASTM B-3.
 - 3. Stranded conductors shall be assembled in accordance with the requirements of ASTM B-8.
- E. Insulated Conductor (Equipment grounding conductor)
 - 1. Size in accordance with NEC Article 250-95 unless otherwise shown as oversize.
- F. Ground Bus Bar
 - 1. ASTM B187, 98% conductivity copper bus bar, size 4 inches wide by 1/4 inch thick by 24 inches long.
- G. Terminal Lugs
 - 1. For 4/0 AWG and smaller conductors: Copper compression lugs.
 - 2. For 250kcmil and larger: Aluminum mechanical lugs.
- H. Bonding Plates, Connectors, Terminals and Clamps
 - 1. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- I. Jumpers
 - 1. Copper braided or leaf-type flexible jumper, size as necessary.
- J. Bus Bar Insulators

1. Fiberglass reinforced polyester insulator with 2 inch diameter threaded holes at both ends for bus bar installation.

K. Electrical Grounding Connection Accessories

1. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.

L. Field Welding

1. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correction welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes.

M. Grounding Resistors

1. Provide a low-resistance grounding resistor in compliance with the latest IEEE-32 standard.
2. Temperature rise shall not exceed 760 degrees C above an ambient temperature of 30 degrees C for a ten-second duration.
3. Neutral grounding relays shall be set to protect the resistor and clear the fault within ten-seconds.
4. For resistors above 600V, an applied high potential test shall be performed equal to 2.25 times the rated voltage, plus 2000 volts.
5. Grounding resistors shall be UL or CSA listed and labeled.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's Standard of Installation, and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Ground each separately-derived system neutral to nearest cold water piping, service entrance equipment grounding electrodes, and building steel.
- D. Connect together system neutral, service equipment enclosures, building steel, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- E. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.02 GROUND INSTALLATION

A. Equipment Grounding Conductor

1. Provide separate, insulated conductor within each feeder and branch circuit raceway including ~~lighting circuits~~.

2. Terminate each end on suitable lug, bus, bushing, or device.
- B. Motors or equipment rated at 480V shall have bonded ground jumpers from feeder conduit to motor frame.
- C. Grounding bushing shall be used wherever conduits are grounded.
- D. Ground the electrical service system neutral at service entrance equipment to the grounding electrode system.
- E. Install rod electrodes at locations indicated.
- F. Provide grounding well pipe with cover at rod locations where indicated. Install well pipe top flush with finished grade.
- G. Install products in accordance with manufacturers instructions.
- H. Use mechanical connections in above ground and accessible locations and use exothermic connectors in underground and inaccessible locations.
- I. Provide bonding to meet Regulatory Requirements. Include bonding of metallic gas and sprinkler piping systems.
- J. Install ground clamps specifically designed for grounding purposes. Where grounded conductor is in conduit, use ground clamp which grounds both conductor and conduit. Strap metal is not acceptable for grounding and bonding.

3.03 GROUND RESISTANCE TESTING

- A. Grounding electrode resistance testing shall be accomplished with a ground resistance direct reading single test meter utilizing the fall-of-potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the concrete-encased ground electrode to be tested and the two reference electrodes in a straight line spaced fifty (50) feet apart. Drive the two reference electrodes five (5) feet apart.
- B. Maximum grounding system resistance to be 5 ohms for secondary systems. Install additional ground rods as needed to achieve a resistance of 5 ohms.
- C. Test results shall be provided in writing and shall show temperature, humidity and condition of the soil at the time of the tests.

END OF SECTION

SECTION 16170

CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc. (UL)
 - 13. International Building Code(IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

A. Submit shop drawings per Section 16050 for review including the following:

1. Voltage and current ratings
2. NEMA enclosure type
3. Horsepower and fault current rating
4. Dimensions
5. Fuse type and class

PART 2 - PRODUCTS

- 2.01 Disconnects shall NEMA 1, indoor type, or rated for the locations in which they are installed as noted on the construction documents.
- 2.02 Disconnects shall be UL listed and suitable for the application.
- 2.03 Disconnects in exterior, wet, cold, warm, or hot environments shall be raintight, have raintight hubs, and be rated NEMA 3R.
- 2.04 Disconnects shall be heavy-duty type, rated 600V with current capacity as noted on the construction documents. Verify NEMA configuration with construction documents.
- 2.05 Disconnects shall have hinged, lockable, dead-front doors with permanently marked ON/OFF indicators. Enclosures shall be baked enamel factory painted steel with conduit knockouts.
- 2.06 Disconnects shall be operated by a handle accessible from the exterior of the enclosure. Handles shall have provision to be padlocked in the OFF position.
- 2.07 All current carrying parts shall be high conductivity copper designed to carry rated load without damage from heat and plated to resist corrosion.
- 2.08 Switch mechanism shall be a quick-make, quick-break type such that the operation of the contact is restrained by the handle during the closing or opening operation.
- 2.09 Switches shall have a minimum fault current rating of 200,000A RMS.
- 2.10 All switches shall be fused unless specifically noted otherwise.
- 2.11 The disconnect door cover shall have an interlocking mechanism to prevent opening the cover when the switch is in the ON position.
- 2.12 Fuses serving motor loads shall be Class L and Class RK1, 250V and 600V, time delay, dual element unless noted otherwise on the construction documents.
- 2.13 Fuses serving non-motor loads shall be Class L and Class RK1, 250V and 600V, fast acting, dual element unless noted otherwise on the construction documents.
- 2.14 Provide built-in fuse pullers.
- 2.15 Acceptable manufacturers shall be General Electric, Siemens, or Square D. Fuses shall be Gould-Shawmut or Bussman.

PART 3 - EXECUTION

- 3.01 Installation method of disconnects shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.

- 3.02 Install all disconnects in accordance with the manufacturer's recommendations and requirements.
- 3.03 Coordinate disconnect mounting height, location and type with architectural, mechanical, and interior drawings. Coordinate with other trades to identify conflicts with device locations and notify the Engineer of any conflicts. Mount switches 42" above finished floor unless noted otherwise.
- 3.04 Provide suitable galvanized metal strut framework where no wall or structure is available for the mounting of disconnects.
- 3.05 Provide flexible conduit connections for disconnects mounted to strut framework, motors, or vibrating equipment.
- 3.06 Tighten and inspect all connections and reconnect or repair wiring as necessary.
- 3.07 Test all disconnects for voltage level, continuity, ground fault, and short circuits. Check switch mechanism operation under no load conditions prior to operating under load.
- 3.08 Install all disconnects plumb and square to structure and adjacent surfaces.
- 3.09 Provide and install all fuses sized per the equipment manufacturer's recommendation.

END OF SECTION

SECTION 16460

TRANSFORMERS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc.(UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Architect, Engineer, and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

A. Submit shop drawings per Section 16050 for review including the following:

1. Voltage, kVA, impedance, frequency, taps, and efficiency
2. Temperature rating above ambient
3. Regulation and sound levels
4. Mounting details and vibration isolation
5. Nameplate data

PART 2 - PRODUCTS

- 2.01 Transformers shall be general purpose, energy efficient, ventilated dry-type, factory assembled, dead-front, metal enclosed, self-supporting floor standing as noted in the construction documents.
- 2.02 Transformers shall be 480V-208Y/120V 3PH 4W(primary-secondary) voltage rated, unless noted otherwise.
- 2.03 Transformers shall be rated for 80 degrees C rise above an ambient temperature of 40 degrees C.
- 2.04 Transformers shall have Class 220 coil insulation minimum.
- 2.05 Coils shall be continuously wound non-hygroscopic type with thermosetting varnish. Windings shall be copper.
- 2.06 Taps shall be provided at primary windings with (6) 2 1/2% taps, three above and three below rated voltage.
- 2.07 Integral vibration isolators shall be provided between the core and coil assembly and the transformer enclosure in addition to the vibration isolation located between the enclosure and the floor.
- 2.08 Grounding shall be provided by means of a flexible grounding strap.
- 2.09 Transformers shall be suitable for the environment in which they are located and shall be NEMA 1, indoor, unless noted otherwise on the construction documents.
- 2.10 Transformers shall have lifting lugs and be enclosed in a heavy gauge, sheet steel housing with baked enamel finish. The enclosure shall be ventilated.
- 2.11 Transformers located in exterior areas shall be NEMA 3R, with drip shield and corrosion resistant finish.
- 2.12 Transformers shall comply with the latest ANSI and NEMA ST-20 sound performance requirements and as a minimum exceed the requirements by 3 dB.
- 2.13 Transformers 15kVA and larger shall comply with the latest NEMA TP-1 energy efficiency requirements as mandated by California Administrative Code Title 20 and 24.
- 2.14 Acceptable manufacturers shall be General Electric, Siemens, or Square D.

PART 3 - EXECUTION

- 3.01 Installation method of transformers shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.02 Install all transformers in accordance with the manufacturer's recommendations and requirements.

- 3.03 Coordinate transformer location and size with architectural and interior drawings. Coordinate with other trades to identify conflicts with transformer locations and notify the Engineer of any conflicts.
- 3.04 Coordinate transformer size with concrete housekeeping pads, structural frames, and mounting hardware.
- 3.05 Brace transformers per California Code of Regulations, Title 24, Seismic Design Category D requirements.
- 3.06 Provide rubber vibration isolation between transformer and floor, structure, or any fixed surface (including wireways).
- 3.07 Test all transformers for voltage level at primary and secondary windings.
- 3.08 Install all transformers plumb and square to structure and adjacent surfaces.
- 3.09 Connect and inspect all ground bonds prior to energizing transformer.
- 3.10 Install all conduit connections to transformer with liquid tight flexible conduit.
- 3.11 Clean all transformer interiors and exteriors prior to handing over to Owner. Touch up scratched paint and finishes as necessary.
- 3.12 Tighten and test all connections prior to energizing the transformer.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc.(UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Architect, Engineer, and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.03 SUBMITTALS

A. Submit shop drawings per Section 16050 for review including the following:

1. Panelboards
2. Overcurrent protection, bus capacity, main ratings, AIC rating
3. Mounting, enclosure, dimensions
4. Voltage, ratings, and phases
5. Device settings, trip ratings, and layout

PART 2 - PRODUCTS

- 2.01 Panelboards shall be factory assembled, dead-front, metal enclosed, wall mounted type as noted in the construction documents.
- 2.02 Panelboards shall be rated 600VAC and shall not exceed 400A current capacity, unless specifically noted on the construction documents.
- 2.03 Panelboard finish shall be baked enamel factory paint of manufacturer's standard color.
- 2.04 Provide front accessibility for wireways on each side of overcurrent protective devices for entire height of panelboard.
- 2.05 All bussing shall be silver-plated copper with ratings as indicated in the construction documents.
- 2.06 Panelboard bussing and devices shall be rated for the available short circuit current as determined by the Contractor's short circuit study (see requirements in Section 16420).
- 2.07 Enclosures shall be galvanized sheet steel cabinet type with hinged and lockable doors, dead front, and permanently adhered identification labels on the front.
- 2.08 Panelboards shall be suitable for the environment in which they are located and shall be NEMA 3R, outdoor, unless noted otherwise on the construction documents.
- 2.09 Circuit breakers shall be molded case type; all circuit breakers shall be bolt-on type.
- 2.10 Main lugs shall be anti-turn solderless pressure type for use with copper conductors.
- 2.11 Instrumentation shall be provided where noted.
- 2.12 Enclosures, panel interiors, and devices shall be of one manufacture.
- 2.13 Provide a typewritten panel schedule located in a sleeve on the interior of the panelboard door indicating loads and areas connected to each circuit.
- 2.14 Provide a ground bus in each panelboard.
- 2.15 Acceptable manufacturers shall be General Electric, Siemens, or Square D.

PART 3 - EXECUTION

- 3.01 Installation method of panelboards shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.02 Install all panelboards in accordance with the manufacturer's recommendations and requirements.
- 3.03 Coordinate panelboard location and size with architectural and interior drawings. Coordinate with

other trades to identify conflicts with panelboard locations and notify the Engineer of any conflicts.

- 3.04 Fasten panelboards securely to structural wall or surface to Seismic Design Category D requirements. Panelboards shall be mounted no higher than 6'0" to the highest device from finished floor and no lower than 24" above finished floor. Provide panel skirts where noted.
- 3.05 Provide a minimum of five (5) empty ¾" conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as "SPARE".
- 3.06 Check all connections, phase rotation, ground resistance and insulation resistance levels.
- 3.07 Complete the panel schedule card and place in the sleeve on the interior of the panelboard door.
- 3.08 Test all panelboards and overcurrent protection devices for voltage level, continuity, ground fault, and short circuits.
- 3.09 Install all panelboards plumb and square to structure and adjacent surfaces.
- 3.10 Connect and inspect all ground bonds prior to energizing panelboard.
- 3.11 Demonstrate the proper operation of all ground fault protective devices.
- 3.12 Clean all panelboard interiors and exteriors prior to handing over to Owner. Touch up scratched paint and finishes as necessary.
- 3.13 Adjust and set all devices for proper operation.

END OF SECTION

SECTION 16510

LIGHTING CONTROLS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 SCOPE

- A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans and as further defined herein:
 - 1. The system shall include, but may not be limited by the following list:
 - a. Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relays, which are controlled via a complete list of communications based accessories including:
 - i. Softwire (digital) switches
 - ii. Softwire (digital) photocells
 - iii. Digital Time Clock and interface cards to dimming systems
 - iv. Building automation systems
 - v. Thermostats
 - vi. Any contact closure or analog based output device.
- B. The type of lighting control equipment and wiring specified in this section is covered by the description: Microprocessor Controlled Relay Lighting Control system with RS485 Bus communications.
- C. Requirements are indicated elsewhere in these specifications for work including, but not limited to: raceways, electrical boxes and fittings required for installation of control equipment and wiring. They are not the work of this section.

1.03 QUALITY ASSURANCE AND STANDARDS

- A. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications and supplements, of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)

9. National Electrical Manufacturer's Association (NEMA)
10. National Electrical Testing Association (NETA)
11. National Fire Protection Association (NFPA)
12. Underwriters' Laboratories, Inc. (UL)
13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the Contractor.

- B. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- C. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the Contractor.
- D. Manufacturers: Products shall be manufactured by Lighting Control & Design (LC&D), or approved equal. Such firms shall be regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years. Any product other than those listed in this specification must be pre-approved a minimum of two (2) weeks prior to bid time. No exceptions.
- E. Major Components: All major components of the system shall be standard catalog items available through electrical distributors. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725.
- F. System Checkout: A trained electrician shall functionally test each component in the system after installation to verify proper operation and confirm that the panel and switch wiring conform to the wiring documentation. The Electrical Contractor (EC) is required to phone LC&D a minimum of 7 days prior to turn over for system checkout. At time of LC&D contact, all components providing telephone service to the modem must be installed, powered and operational.
- G. NEC Compliance: Comply to NEC as applicable to electrical wiring work.
- H. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment enclosures.
- I. Approvals: Lighting Control panels are to be ETL listed to UL 916.

1.04 SUBMITTALS

- A. Product Data: Submit for prior approval, copies of manufacturer's data on the specific lighting control system and components as indicated in Section 16050. Submittal shall be in both electronic and hard copy formats. To prevent departures from approved system operation, electronic file submitted shall be able to be directly downloaded to the specified system.
- B. Shop Drawings: Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches and time clocks and interfaces.

- C. One Line Diagram: Submit a one line diagram of the system configuration proposed indicating the type, size and number of conductors between each component. Submittals that show typical riser diagrams are not acceptable.
- D. Bill of Materials: Submit a complete bill of materials with part numbers and voltage specifications.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. LIGHTING CONTROL PANELS

1. Relay Panel. Panels shall be made up of the following components:
 - a. NEMA rated enclosure with screw cover or hinged door. Rain tight or oil tight versions shall be available as an option.
 - b. 16 gauge steel barrier shall separate the high voltage and low voltage compartments of the panel. Additionally, any panels with multiple voltages (e.g.: 120V and 277V) shall have barriers provided to separate each section.
 - c. Output Relays mounted in "Snap Track" such that they are easy to insert or remove. Relay terminal blocks are to be capable of accepting two (2) #10AWG wires on both the line and the load side. Blocks shall be securely anchored to prevent twisting when tightening down the screws. Systems that do not allow for individual relay replacement or additions shall not be acceptable.
 - d. Transformer: Primary shall be dual voltage accepting either 277V or 120V without special wiring. Voltage selection shall be by a rotary switch with an OFF position to turn off the power to the transformer for maintenance. Both 277V and 120 V inputs shall be protected on the primary side.
 - e. Low voltage power supply shall be capable of driving at least 48 relays and their electronics. Such power supply is to have surge protectors on the AC inputs of the power supply to limit spikes into the system. Diode isolated power shall be provided for the electronics separate from the power for the relays. Low voltage power shall have a thermal fuse for current limiting and automatic return of power once the fault has been removed. The data line is to be protected from spikes and from inadvertent connection of 12-volt power to the data line.
 - f. Control cards that drive the relays shall have the following features:
 - i. Control cards shall be available to individually drive 2 to 48 relays.
 - ii. All control cards shall be capable of controlling relays in groups or individually to any time schedule or input.
 - iii. Each relay and zone shall be individually controlled by on-board switches. Indicator LED's indicate status of each relay or zone.
 - iv. A manual override switch shall place all zones in the ON position without overriding the relay button status LED. This is for the purposes of programming and testing without disturbing the loads connected to the panel.
 - v. Each card has an address button for setting the address of the card.
 - vi. All card parameters are to be stored in non-volatile memory and after a power outage such parameters shall restore system to the programmed status at the time power is restored.
 - vii. Cards shall be controlled by digital switches or other devices mounted on the bus.

- viii. Each zone shall be capable of timer programming from 1 minute to 4 hours with or without a blink warning before light shut off. These timers may be disabled by a clock or other feature on the bus that prevents "Off Sweeps" from occurring during normal business hours.
- ix. Each zone shall be capable of driving Normally Open (NO) or Normally Closed relays (NC).

2. Standard Output relays

- a. Type: Electrically held SPST relay.
- b. Rating: 20 Amp, 277VAC Ballast and Tungsten, 1 HP at 120 VAC, 2 HP at 240 VAC.
- c. Number per panel: 2 through 48 as shown on the plans. Micro panels shall have up to 4 relays.
- d. Relays are to be individually exchangeable with plug in low voltage connectors. Panels that require more than one relay to be changed in event of single relay failure are not acceptable. No exceptions.
- e. Relays shall be rated for 40,000 operations minimum, Normally Closed (NC) and Normally Closed SoftStart (NCSS). All incandescent circuits shall be energized by use of a Normally Closed SoftStart relay. No exceptions.
- f. Relays are to incorporate a Class B insulation system to enable them to withstand elevated temperatures.
- g. Optional relay types available shall include: Normally Open (NO) relay rated for 100,000 operations; NO and NC relays with at zero cross circuitry rated for 250,000 operations, (NCZC, NOZC); Single Pole, Double Throw (SPDT).

3. Switches

- a. Switches of different styles shall be available that fit into "Decora" shaped wall plates. All switches shall be communications based (RS485). Contact closure style switches shall not be acceptable. Any switch button function shall be able to be changed through remote or local programming.
- b. Switches shall be available in 1 through 6 button versions with engravable buttons. Indicator LEDs for each button and a constantly ON locator lamp shall be built into each switch.
- c. Switches may be programmed to be Momentary ON, Momentary OFF, Toggle or Maintained type switches.
- d. Switches shall show the status of the zone or zones controlled by LED output. LEDs for the OFF status shall also indicate as well.
- e. Switches by third parties or inputs from EMS system shall be connected to the system bus via a DigiLink input card. (1) DigiLink input card shall provide (14) global programmable inputs.
- f. Digital Key_Switch (KS2400) shall be available as a single gang device and shall provide a momentary ON and OFF to assigned relays (loads) as programmed.
- g. Digital switches shall accept input from a "Key Enable" (KES2400) switch. Key Enable switch shall be able to enable and disable up to (3) single gang digital switches.
- h. Contractor to verify all switch types and quantities per plans and specifications.

4. Clock Interface

- a. A Digital Astronomical Time Clock (DATC) shall control and program the system and supply all time functions.

- b. Such DATC shall be capable of up to (32) schedules. Each schedule shall consist of one set of ON and OFF times per day for a week, with separate schedules for each of (2) holiday lists. The schedules shall apply to a specific group of relays.
- c. The DATC shall be capable of controlling up to (126) digital devices on the bus.
- d. The DATC shall be able to accept control from a computer or modem via an on-board RS 232 port.
- e. The DATC display shall be a (8) line 21-character display. All commands shall be in plain English. Help pages shall contain the manual for the clock in event of loss of the original.
- f. The DATC shall be capable of accepting digital thermostat information via a T-Link Interface.
- g. The DATC shall be run from non-volatile memory so that all system parameters are maintained indefinitely during power outages. Only the Real Time Clock section of the DATC shall require a battery. Battery shall hold the time for a period of ten years from installation even if system is not powered.

5. Other Interfaces

- a. When indicated on the plans, specified system shall provide a dry contact gateway using an interface card. Interface card (DigiLink) shall provide 14 closure (global, programmable) inputs per card with on-board push buttons to simulate a contact closure, and on-board LED load status indication. Dry contact inputs must connect to DigiLink via use of shielded cable.
- b. When indicated on the plans, specified system shall provide a Local Area Network Interface (LanLink). LanLink shall connect multiple 128-device buses, (up to 12,000 total devices) via full-duplex twisted pair copper conductors, separate transmitters and receivers and provide up to 8 LAN-Wide universal commands. Each bus can be up to 4,000 feet apart.
- c. When indicated on the plans, specified system shall provide a Local Area Network Interface via a fiber optic cable (FiberLink), 2 strands allotted (Duplex 62.5 micron multimode optic fiber cable). FiberLink shall connect multiple 128-device buses, (up to 12,000 total devices) via full-duplex optical transceivers, separate transmitters and receivers and provide up to 8 LAN-Wide universal commands. Each bus can be up to 2 Km apart.
- d. When indicated on the plans, specified system shall provide direct digital interface cards (Link To Series) that allows communications based (RS 232, RS485) inputs and outputs to third party EMS systems and third party dimming systems. Link To cards shall provide real time control of any relay or zone in any panel connected on the bus.
- e. When indicated on the plans, specified system shall provide a voice prompted telephone override module (TeleLink). TeleLink shall accept up to (3) phone lines and allow up to (3) simultaneous phone calls. Voice prompted menu and up to (999) unique passcodes shall be standard with each TeleLink module.
- f. When indicated on the plans, specified system shall provide an exterior (PCO) or interior (PCI) mounted photocell with interface card that provides a read out on the DATC screen in number values analogous to foot-candles with spectral sensitivity similar to the human eye. Each photocell card shall be capable of programming up to (14) trigger points. Each trigger may be set with a unique ON and OFF light level, and may be programmed to control a unique group of relays. All trigger settings shall set through programming only. Photocell system, which requires

- the use of set screws or which must be programmed at the photocell control card shall be not acceptable.
- g. When indicated on the plans, specified system shall provide a direct digital interface card (T-Link) that allows the system DATC to control up to (32) digital, XCI brand, thermostats. Programming of thermostats to be able to done locally (at the DATC or a EMS PC) or remotely, via modem.
 - h. Specified system shall have software pre-installed to accept Graphical Management Software (GMS) pages. GMS software shall provide via local or remote PC a visual representation of a specific area or the total area of the project. Each GMS page shall be designed to the owner's specifications. Provide ___ GMS Page(s)___ GMS Page(s) Not Required.
 - i. Modem. Modem shall allow for remote programming from any location using either a PC or similar GR 2400 system device.
 - j. When indicated on the plans, specified system shall provide a direct digital interface to motorized panelboards. Relay panel and motorized panelboard circuits shall appear on the system software as similar items and maintain all functions and features of the software.
 - k. Specified system shall have all interfaces listed above available at time of shipment even if a particular interface is not part of the original specification for this project. No exceptions.

2.02 MODES OF OPERATION

- A. Softwired Switches: Remote switches shall be able to control any relay or group of relays in the following modes: ON, OFF, Mixed (Some relays ON some OFF), Toggle (first push ON, next OFF etc.) Maintain. Timer ON with a time set from 1 minute to 4 hours. Timer ON with OFF sweep warning, (Blink warning 5 min or as programmed prior to OFF sweep.) Timer ON with Horn Warning (Horn output turns ON for the warning 5 min or as programmed prior to OFF sweep).
- B. DATC Operation: DATC shall control any relay or group of relays with the following modes as determined by schedules: ON only, OFF only, maintained, maintained with timer and OFF sweep warning (blink warn), maintained with timer (no blink warning). Timers adjustable from 1 minute to 4 hours. When the scheduled program in the DATC is ON, the associated timers are disabled. When the scheduled program in the DATC is OFF and a relay or zone is overridden, the DATC will put that relay or zone into the timer mode and automatically sweep OFF at the end of the programmed timer period. Timers shall be able to be changed though software, locally and remotely. No exceptions.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION AND DOCUMENTATION

- A. Installation: Mount relay control cabinets adjacent to respective lighting panelboard. Cabinet shall be surface or flush mount, per plans. Wiring between relay control cabinet and panelboards to be per local codes and acceptable industry standards. Under no circumstances shall additional fees be authorized for payment to the EC or GC due to the EC's lack of knowledge or understanding of any and all prevailing codes or specified manufacturer's installation requirements. Neatly lace and rack wiring in cabinets.
- B. Switch Mounting: Provide outlet boxes, single or multi-gang, as shown on the plans for the low voltage digital switches. Mount switches as per plans. EC is specifically responsible to run the required low voltage cable (Category 5, 4 unshielded twisted pairs) between all switches and panels. All low voltage wire to be run in conduit, per local codes.
- C. Wiring (Additional)

1. Do not mix low voltage and high voltage conductors in the same conduit. No exceptions.
2. Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.
3. Place "terminators" at each end of the bus to maintain data integrity, per the manufacturer's recommendations.
4. Neatly lace and rack wiring in cabinets.
5. Land control wires on the de-pluggable connectors provided.
6. Use Category 5, 4 unshielded twisted pair cable for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Contact LC&D or refer to the GR2400 manual for further information. Use shielded cable for dry contact inputs.
7. Do not exceed 4000ft of wire length for the system bus.
8. All items on the bus shall be connected in sequence. Star and Spur topologies are not acceptable.
9. The specified lighting control system shall be installed and wired as shown on the plans, by the electrical contractor, who shall make all necessary wiring connections to external devices and equipment, to include photocell.

D. Documentation

1. Each relay shall have an identification tag indicating the originating branch circuit number and panelboard name along with the relay number as indicated on the drawings.
2. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.
3. Provide a point-to-point wiring diagram for the whole system on the inside cover of each cabinet.
4. Accurate "as built" drawings shall be furnished by the contractor to the owner. These shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell.

3.02 SERVICE AND SUPPORT

- A. Start Up: EC shall contact LC&D at least 7 days prior to project completion. LC&D will remotely dial up the lighting control system. EC shall be available at the time of dial up to perform any corrections required. EC is responsible for coordinating with GC and the owner the installation of a dedicated telephone line or a shared phone line with A/B switch. Phone jack to be mounted within 12" of the master LCP. Label jack with phone number. EC to connect phone line from jack to the master LCP.
- B. Factory Support: Telephone factory support shall be available at no additional cost to the EC or Owner both during and after the warranty period. Factory to pre-program the lighting control system, per plans and specification, to the full extent of the data available. The specified manufacturer, at no added cost, shall provide additional programming via modem as required by the EC or Owner. Manufacturer warrants that the DTC software can be upgraded and monitored remotely. Upon request, manufacturer to provide remote dial up software, at no added cost, to system owner. No exceptions.

END OF SECTION

SECTION 16520

INTERIOR LIGHTING

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 SCOPE

- A. Provide labor, materials, tools, and equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the equipment of this section, as shown on the drawings and specified herein.
- B. Furnish and install complete lighting systems, wired, assembled and operable, except where specifically noted otherwise, which includes but not limited to the following:
 - 1. Luminaires
 - 2. Lamps and ballasts
 - 3. Mounting hardware
 - 4. Accessories as noted
- C. The materials and equipment herein specified shall be of new and furnished in accordance with the applicable standards.
- D. Specifications and drawings are intended to convey the general features, function and character of the fixtures only, and do not illustrate or set forth every item or detail necessary of the work.

1.03 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of the standards listed below form an integral part of this specification:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriters' Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)
 - 14. Illuminating Engineering Society of North America (IESNA)

15. Certified Ballast Manufacturers (CBM)
16. National Appliance Energy Conservation Amendments of 1988 (Public Law 100-357).
17. Materials and equipment as well as workmanship provided under this section shall conform to the highest commercial standards, and as specified and as indicated on the drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion, thermal and mechanical stresses encountered in the normal application and function of the fixtures.

1.04 SUBMITTALS

- A. Shop drawings for all fixtures shall be submitted and reviewed prior to fabrication. Any material produced prior to the review of shop drawings or samples, and not in conformance with the Contract Documents, shall be rejected with the Contractor bearing full responsibility and cost. Submit shop drawings per Section 16050 for review, include the following:
 1. Luminaires
 2. Lamps
 3. Ballasts
 4. Photometric reports
 5. Point-by-point calculations specific to the project.
 6. Accessories
- B. Submit shop drawings indexed, and in accordance with luminaire identification per drawings. Each item shall be tabbed, clearly identifying the catalog ordering numbers including all optional equipment specified.
- C. Luminaire shop drawings shall include the following:
 1. Manufacturers product information sheets. Photocopy of partial data sheet or drawings is not acceptable. Product information shall include the following:
 - a. Ballast type, manufacturer and performance characteristics
 - b. Lamp type, manufacturer and performance characteristics
 - c. Finish, frame, trim and housing type
 - d. Reflector system and characteristics
 - e. Diffuser type and characteristics
 - f. Weight and dimensions
 - g. Standard manufacturer options
 - h. Luminaire series and model number
 - i. Luminaire efficiency
 - j. Coefficient of utilization
 - k. Candlepower data table
 - l. Zonal lumens table
 - m. IES luminaire classification
 - n. Maintenance and operating instructions including tools required, types of cleaners to be used and suggested replacement parts list.
 - o. Average foot candle table.
 2. Photometric data assembled in a standard IES photometric test report.
- D. Lamp shop drawings shall include type, dimensions, manufacturer and operating characteristics, including but not limited to:
 1. Operating voltage range
 2. Color Rendering Index (CRI) value per IES standards

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3. Color temperature (in Kelvin)
 4. Mounting position
 5. Starting temperature, indoor and outdoor
 6. Starting/restrike time
 7. Lamp life
 8. Lamp efficiency
 9. Warranty
 10. Lamp base
 11. Lumen rating
- E. Ballast shop drawings shall include type, dimensions, manufacturer and operating characteristic including but not limited to:
1. Ballast operating temperature and voltage
 2. Total harmonic distortion
 3. Ballast starting/restrike time
 4. Ballast efficiency factor (BEF)
 5. Ballast transformation type (ie: autotransformer, preheat, instant-start, rapid start, constant wattage, reactor, trigger-start)
 6. UL classification (ie: Class "P")
 7. Power factor
 8. Sound rating (fluorescent only)
 9. NEMA rating
- F. If requested by the Engineer, samples shall be submitted for final selection. Samples shall comply with the following:
1. Paint chips:
 - a. Samples shall be provided and approved prior to any release to manufacture.
 - b. Samples shall be minimum of 3"x3" and be of exact finishes.
 - c. Samples shall be exact representatives of the luminaires:
 - i. Priming process
 - ii. Painting process
 - iii. Baking process
 - iv. Finish process
 - v. Luminaire material (i.e. sheet metal, aluminum, wood, etc)
 - d. Samples shall be labeled with manufacturers color call-out, as well as the paint manufacturers call-out.
 2. Fixtures:
 - a. Submit for approval samples called for to the Engineer when and where directed, the components marked with the name of the project, and fixture type, and part number. Fixture shall be provided with a 6' cord and plug, and specified lamp. Allow two weeks from the date of receipt for thorough examination and review by the Engineer.
 - b. Fixtures under the contract shall be identical with the approved sample fixture. No fixture used as a sample shall be allowed to be installed on the project.
 - c. In the event the submissions are disapproved, the fixtures shall be returned to the contractor to immediately make a new submission of fixture or fixtures meeting the contract requirements.
 - d. All charges for these shipments are to be prepaid by the Contractor.
 - e. Samples shall be provided and approved prior to any release to

manufacture.

1.05 FACTORY TESTING

- A. Luminaire testing shall be conducted by an approved independent testing laboratory.
- B. Luminaire tests shall be reported in accordance with Illuminating Engineering Society (IES) Standard Photometric Test Report.

1.06 WARRANTY

- A. Contractor shall warranty equipment and installation free from defects in material and workmanship for a period of no less than (1) year from the date of project completion. This includes the fixture, its finishes and components (see ballasts below).
- B. Fluorescent ballasts shall be warranted against defects in material and workmanship for a period of no less than (5) years for electronic ballasts, from the date of project completion regardless of the date of manufacture.
- C. HID ballasts shall be warranted against defects in material and workmanship for a period of no less than (2) years from the date of project completion regardless of the date of manufacture.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Luminaires shall bear the appropriate UL label for location, mounting position and operating conditions in which it is installed.
- B. Luminaires, ballasts and lamps shall each be of the same manufacturer and of identical finish, appearance, and performance. Luminaires which are pre-lamped before shipment shall have identical lamp manufacturer. Mix and match of different lamp manufacturer shall not be acceptable.
- C. Recessed ceiling mounted luminaires shall be provided with appropriate frame and trim type compatible with ceiling construction. Reference architectural plans for ceiling construction type and specifications.
- D. Luminaires and devices shall be free of burrs, scratches, marks, and dents which may occur during transportation, storage or installation. Construction shall be finished to eliminate sharp edges exposed to installer and end-user.
- E. Sheet metal construction of luminaires shall be of sufficient rigidity to prevent deformation during installation and typical use.
- F. Cast parts and sections of a luminaire shall be smooth, free of blemishes, rust and scale and be irradiated, sandblasted and anodized.
- G. All burned out lamps and ballasts shall be replaced by the end of contract prior to Architect, Owner Representative and Engineer final punchlist.
- H. Trim color for indoor luminaire installation shall be as indicated on plans.
- I. Enamel paint shall be baked on at a minimum 300 degrees F and have 86% reflectivity for a surface, which is to be reflective.

2.02 LAMPS

A. Fluorescent lamps

1. Unless specified on plans or in Lighting Fixture Schedule, the lamp color temperature shall be 3500 Kelvin (K).
2. Unless otherwise noted, lamps shall have a CRI (color rendering index) of 82 or greater.

B. Compact Fluorescent

1. Unless specified on plans or in Lighting Fixture Schedule, the lamp color temperature shall be 3500 Kelvin (K).
2. Unless otherwise noted, lamps shall have a CRI (color rendering index) of 82 or greater.
3. Lamp base and fixture socket shall match pin configuration.

C. Acceptable manufacturers

1. Fluorescent Lamps: Osram/Sylvania, 800 XP series

D. All lamps shall be burned once installed in the fixtures for 100 hours, prior to switching or dimming.

2.03 BALLASTS

A. General

1. Ballasts shall be UL listed when installed in luminaire.
2. Ballasts shall be grounded appropriately as governed by NEC Article 410-E.
3. Ballasts shall be located within the luminaire for which it is operating unless specifically indicated on plans as remote ballast type.
4. Ballasts shall contain no PCB's in any indoor or outdoor installation unless otherwise noted.
5. Ballasts shall be rated weatherproof type where there is moisture present.
6. A permanent waterproof seal shall be factory provided where the wiring enters the ballast compartment of an outdoor luminaire installation.

B. Fluorescent ballasts

1. Solid State Ballasts (Electronic)

- a. Electronic ballasts shall meet or exceed ANSI, IEEE, and FCC standards for lamp starting and operation, electromagnetic interference, radio frequency interference suppression and line transient protection.
- b. Electronic ballasts shall not interfere with other electrical equipment normal operation.
- c. Electronic ballasts shall operate at a frequency of 20 to 35kHz with no detectable flicker and be high power factor (97% or higher).
- d. Electronic ballasts that operate more than one lamp shall be able to maintain full output of the companion lamp(s) after failure of any combination of lamp(s).
- e. Electronic ballasts shall not be affected by lamp failure nor hinder the normal life of operating lamp.
- f. Electronic ballast normal case operating temperature shall not exceed 70 degrees C.
- g. Rapid-start electronic ballasts shall provide soft/stable start of rapid-start lamps and maintain full cathode heat during operation.

- h. Electronic ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and bear all applicable UL listings on housing.

C. Acceptable Manufacturers

- 1. Solid state ballasts (electronic): Osram Sylvania or, Quicktronic, or approved equal.

2.04 LUMINAIRES

A. General

- 1. Escutcheon plates, coverplates, and finish trim hardware shall meet flush with ceiling, floor, wall or other surfaces to which they may be mounted.
- 2. Luminaire construction shall allow initial installation of recessed luminaires without the presence of finish trim, diffusers or lens.
- 3. Lamp sockets and reflector assemblies shall be securely fastened to luminaire housing to prevent rotation, adjustment or rocking of hardware during lamping or future relamping.
- 4. Luminaire lenses shall be securely retained in a fashion so that relamping or accessing to luminaire will not dislodge lens.
- 5. Luminaire lenses and diffusers shall be free from chromatic or spherical imperfections and have thermal characteristics capable of withstanding installed lamp temperatures.
- 6. Bracket type luminaires shall be specifically designed for type installation which is indicated.
- 7. Luminaires shall be factory tested, prewired and preassembled unless otherwise specified or intended.
- 8. Luminaires located in direct exposure to the weather to include rain, sleet and snow shall be marked "Suitable For Wet Locations" with UL label. Luminaires located outdoors but not in direct exposure to rain shall be marked "Suitable for Damp Locations" minimum rated.
- 9. Where ceiling space is not accessible, luminaire housing shall provide access to luminaire junction box to comply with NEC section 370-29.
- 10. Luminaires shall contain an integral ballast disconnect compliant with NEC section 410.73.

B. Fluorescent Luminaires

- 1. Recessed fluorescent luminaires shall be constructed to limit ballast housing surface temperature in luminaire to 90°C with the following factors:
 - a. Voltage: 277V +5%
 - b. Room Ambient Temp: 25 degrees C + 5%
 - c. Plenum Ambient Temp: 55 degrees C +5%
 - d. Ceiling Material R Factor: 20
- 2. Medium BiPin type lamp socket shall be fastened securely to housing via brackets or straps to eliminate excessive flexing or pressure during normal lamp installation. Socket should be replaceable without removing entire housing.
- 3. Medium BiPin type lamp sockets without a housing shall be secured with (2) appropriate screws or bolts to prevent misalignment.
- 4. Fluorescent pin type sockets shall utilize corrosion-resistant "edge-wipe" type contacts.
- 5. Steel metal fluorescent luminaire housing shall be constructed of die formed, heavy duty, cold rolled steel. Housing shall be welded using lap seam construction and corners mitered and free of burrs, cracks, gouges, scratches.
- 6. Aluminum fluorescent luminaire housing shall be extruded or die formed in sections.

- 7. which will positively interconnect to provide a rigid unit when assembled.
 - 7. Steel metal construction of fluorescent luminaires housing shall be ribbed, section or paneled to provide internal structure.
 - 8. Parabolic baffle optic control for fluorescent luminaires shall be semi-specular anodized, of low iridescent and constructed of sheet aluminum. Baffle shall be constructed to ensure rigidity and parabolic contours through interlocking cell assembly.
 - 9. Prismatic lenses shall be of virgin acrylic plastic pattern 12 (0.125 inches thick prestressed to span 48-inches) unless specified otherwise on plans.
 - 10. Compact fluorescent luminaire shall incorporate an End of Life (EOL) protection device.
- C. Emergency Lighting Units
- 1. 90 minute internal battery packs
 - 2. IBC/Life safety approved
- D. Acceptable manufacturers shall be as specified on plans per Lighting Fixtures Schedule unless otherwise specified herein or on plans.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Any discrepancies with specified luminaire and its proposed use or environment shall be brought to the Engineer's attention as soon as possible.
- 1. At project close-out, a list of damaged fixtures received by the contractor shall be provided to the Electrical Engineer for evaluation of fixture manufacturers shipping and packaging methods.

3.02 INSTALLATION

- A. Luminaires shall be installed complete with all accessories, glassware, canopies, sockets, reflectors, optics, wiring devices and supplied with new lamps of the type and wattage indicated on plans or in this specification unless specifically noted otherwise.
- B. All luminaires shall be supported in accordance with ASTM E-580 recommended guidelines for seismic restraint, as well as the latest version of the International Building Code related to lateral and vertical bracing, including but not limited to:
- 1. Recessed luminaires shall have a minimum of four (4) #10 gauge wires attached to structure above; (1) wire at each corner of the luminaire. The wires shall be independent of ceiling support system.
 - 2. All lighting fixtures shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100 percent of the lighting fixture weight acting in any direction.
 - 3. Pendant-hung lighting fixtures shall be supported directly from the structure above with #9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.
- C. Mount luminaries in mechanical yards, areas and rooms to clear any mechanical equipment, conduit and clearances. Coordinate mounting with mechanical plans.
- D. Junction box and ballast compartment shall be accessible from below when housing is installed in final position. Wiring shall be secured from damage when accessed for relamping.

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- E. Fire rated gypsum board enclosures shall be constructed around all recessed luminaires that penetrate fire rated areas.
- F. All surface mounted luminaires installed on a suspended ceiling grid shall have four (4) supporting clips positively attaching corners of housing to the ceiling. Installation shall include 1/8" spacers between the housing and ceiling tile where applicable.
- G. Actual locations of luminaires and dimensions shall be referenced to architectural drawings. Electrical plans shall not be used to scale for construction purposes. Any discrepancies shall be brought to the engineer's attention prior to installation.
- H. Utilize modular wiring systems in the installation of luminaires where accessible and applicable. The system shall be complete with all required fittings, plugs, and cord drops for a complete operating system per specifications.
- I. Provide additional junction boxes as required where conductor exceeds factory provided junction box limitations.
- J. Installation shall be appropriately coordinated with all disciplines to insure proper ventilation and heat dissipation as required per manufacturer.
- K. Where luminaires are served from two sources, a barrier shall be provided to separate emergency source from normal source with notation indicating separate sources.
- L. Luminaires not utilizing modular wiring systems, shall be connected with minimum six (6) foot length of flexible metal conduit from a structurally mounted junction box.
- M. Wall mounted luminaires and junction boxes shall be rigidly supported to structure to provide adequate support during normal operation.
- N. Pendant luminaries shall be mounted in a uniform mounting height and in straight, parallel, continuous rows. Final coordination with the architectural reflected ceiling plan, mechanical equipment and plumbing fixtures shall be made in the field to ensure consistent spacing and locations.
- O. All wall mounted fixtures shall be mounted to a supporting wall bracing material in addition to the junction box. The bracing material is secured to structural elements in the wall. The bracing shall be capable of supporting the weight of the fixture and comply with the manufacturer's requirements and recommendations.

3.03 FIELD TESTING

- A. Upon completion of installation, an operation test shall be conducted to show that all equipment operates in accordance with the requirement of this specification.
- B. All applicable tests shall be conducted in the presence of an Owner Representative and copies of any reports shall be provided.
- C. Reports shall indicate when and where the test was conducted and who was present.
- D. Upon completion of installations, luminaires requiring positioning shall be adjusted and aimed at final position.
- E. Exit signs shall be individually reviewed after installation completion to ensure directional arrows are properly provided and positioned.

3.04 CLEANING AND REPAIR

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- A. After complete lighting installation and before project completion, all damaged or faulty lenses or louvers in luminaires shall be replaced by the Electrical Contractor, at no additional cost to the Owner.
- B. All anodized or highly visual or optically sensitive reflectors shall be cleaned of all fingerprints and smudges for a clean installation per manufacturers recommendations.
- C. All luminaries with paint scratches, dents or deformations due to installation or shipping shall be repaired, touched up or replaced as required or deemed necessary by the Electrical Engineer at no additional cost to the Owner.
- D. Upon final installation of individual luminaires, dirt and debris shall be removed from luminaire enclosures.

END OF SECTION

SECTION 16950

OCCUPANCY SENSORS

PART 1 - GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 16050) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.02 SCOPE

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

1.03 EQUIPMENT QUALIFICATION

- A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.04 SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
- C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.05 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
 - 1. American Disabilities Act (ADA)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Institute of Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. Local Code Enforcement Agency Requirements
 - 7. National Electrical Code (NEC)
 - 8. National Electrical Contractor's Association (NECA)
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. National Electrical Testing Association (NETA)
 - 11. National Fire Protection Association (NFPA)
 - 12. Underwriter's Laboratories, Inc. (UL)
 - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.
- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.06 SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
- B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature, which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.07 SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system, or;
- B. Factory Startup: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Occupancy sensor manufacturer shall be The Watt Stopper.

2.02 PRODUCTS

- A. All products shall be Watt Stopper product numbers:
 - 1. Ceiling sensors: WT-605, WT-600, WT-1105, WR-2205, WT-2200, WT-2250, WT-2255, W-500A, W-1000A, W-1050A, W-2000A, W-2050A, W-2000H, W-2050H, WPIR, DT-200, DT-205, CX-100, CX-105, CI-200, CI-205
 - 2. Wall sensors: WI-300, WS-120/277, WA-100, WD-170, WD-180, WD-270, WD-280
 - 3. Power and slave packs: B120E-P, B277E-P, A120C-P, A277C-P, C120E-P, C277E-P, S120/277-P, AT-120, AT-277
 - 4. Low temperature: CB-100
 - 5. Inteliswitch: TS-200, TS-300
- B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300SF, and gross motion up to 1000SF.
- C. Wall switch sensors shall accommodate loads from 1 to 800 watts at 120V; 1 to 1200W at 277V and shall have 180 degree coverage capability.
- D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
- F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
- H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
- I. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
- J. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
- K. Where specified, passive infrared and dual technology sensors shall offer daylighting

footcandle adjustment control and be able to accommodate dual level lighting.

- L. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
- M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- N. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- O. Ultrasonic operating frequency shall be crystal controlled at 25kHz within 0.005% tolerance, 32kHz within 0.002% tolerance, or 40kHz 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- R. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- S. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- T. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- U. Were specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- V. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.03 CIRCUIT CONTROL HARDWARE –CU

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
- B. Relay Contracts shall have ratings of:
 - 1. 13A - 120 VAC Tungsten
 - 2. 20A - 120 VAC Ballast
 - 3. 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or teflon jacketed cable suitable for use in plenums, were

applicable.

- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensor in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION

SECTION 17000

VOICE AND DATA COMMUNICATION CABLING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmissions in HOC/EDA.
- B. At FJC, voice and data communication cabling will be provided by the Owner's separate contractor. Contractor shall coordinate scheduling and installation with the Owner's separate contractor.

1.02 DEFINITIONS

- A. EMD: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. LAN: Local area network.
- D. PVC: Polyvinyl chloride.
- E. UTP: unshielded twisted pair.

1.03 SUBMITTALS

- A. Product Data: Include data on features, rating, and performance for each component.
- B. Shop Drawings: Include dimensioned plan and elevation views of each individual component. Show equipment assemblies, method of field assembly, workspace requirements and access for cable connections.
 - 1. System labeling schedules, including electronic copy of labeling schedules, in software and format approved by the Owner.
 - 2. Wiring diagrams. Show typical wiring schematics including workstation outlets, jacks and jack assemblies, patch cords, patch panels, and fiber optic boxes.
- C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.
- D. Product Certificates: For each type of cable, connector, and terminal equipment, signed by product manufacturer.
- E. Manufacturer Seismic Qualification Certification: Certification that distribution racks and their components will withstand seismic forces. Include the following:
 - 1. Basis for Certification: Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based. Indicate whether withstand certification is based on actual test of assembled components or on calculation. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the specified seismic forces".

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity of each rack-mounted component and of each assembled rack type, and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Qualification Data: For testing agency.
- G. Field quality test reports.
- H. Operation and Maintenance Data: For voice and data communication cabling to include in emergency, operation and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: System installer shall have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the International electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing.
- C. Source Limitations: Obtain all products except twisted pair and fiber optic cables through one source from a single manufacturer. All cabling and connectors shall be compatible and perform as a system.
- D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended purpose.
- E. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate and layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.
1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute to other participants.
 3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.06 EXTRA MATERIALS

- A. Furnish extra materials specified below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Cable: 250-feet of each size and type used. Furnish on reels.
 - b. Patch-Panel Units: One of each type for every six installed, but no fewer than one.
 - c. Connecting Blocks: One for each type for every 25 installed, but no fewer than one.
 - d. Outlet Assemblies: One for each type for every 25 installed, but no fewer than one.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Cable:
 - 1. Belden, Inc; Electronics Division.
 - 2. Berk-Tek; an Alcatel Company.
 - 3. Compscope.
 - 4. General Cable Corporation.
 - 5. Lucent Technologies; Global Service Provider.
 - 6. Mohawk/CDT; a division of Cable Design Technologies.
 - 7. Montrose/CDT; a division of Cable Design Technologies.
 - 8. Optical Cable Corporation.
 - 9. Panduit Corp.
- B. Terminal and Connector Components and Distribution Racks:
 - 1. AMP Incorporated; a Tyco International Ltd. Company.
 - 2. Hubbell Premise Wiring.
 - 3. Leviton Telecom.
 - 4. Lucent Technologies; Global Service Provider.
 - 5. Panduit Corp.
 - 6. The Simon Company.
 - 7. Thomas & Betts Company.

2.02 SYSTEM REQUIREMENTS

- A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

- B. Expansion Capability: Unless otherwise indicated, provide spare fibers and conductor pairs in cables, positions in cross-connect and patch panels, and terminal strips to accommodate 20-percent future increase in active workstations.

2.03 MOUNTING ELEMENTS

- A. Cable Trays: As specified in Division 16.
- B. Raceways and Boxes: As specified in Division 16.
- C. Backboards: 3/4-inch, interior-grade, fire-retardant-treated plywood.
- D. Distribution Racks: Freestanding, modular steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - 1. Approximate Module Dimensions: 84-inches high x 22-inches wide.
 - 2. Finish: Backed polyester powder coat.

2.04 TWISTED PAIR CABLES, CONNECTORS AND TERMINAL EQUIPMENT

- A. Cables: Listed as complying with Category 6 of TIA/EIA 568-A.
- B. Conductors: Solid copper.
- C. UTP Cable: Comply with TIA/EIA 568-A. Four, thermoplastic-insulated, individually twisted pairs of conductors; No. 24 AWG, color-coded; enclosed in PVC jacket.
- D. UTP Cable Connecting Hardware: Comply with TIA/EIA 568-A. IDC type, using modules designed for punch-down caps or tools.
 - 1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
 - 2. IDC Connecting Hardware: Consistent throughout Project.
- E. Cross-Connect Panel: Modular array of IDC terminal blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
 - 2. Mounting: Rack.
- F. Patch Panel: Modular panels housing multiple numbered jack units with IDC type connectors for each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
 - 2. Mounting: Rack.
- G. Jacks and Jack Assemblies for UTP Cable: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service.

- H. UTP Patch Cords: Four-pair cables in 48-inch lengths, terminated with RJ-45 plug at each end. Use keyed plugs for data service.
- I. Workstation Outlets: Dual jack-connector assemblies mounted in single or multigang faceplate.
 - 1. Faceplate: High-impact plastic.
 - 2. Mounting: Flush, unless otherwise indicated.
 - 3. Legend: Factory labeled, top jack "Voice" and two bottom jacks "Data" by silk-screening or engraving.

2.05 FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

- A. Cables: Factory fabricated, jacketed, low loss, glass type, fiber optic, multimode, graded index, operating at 850 and 1300 nm.
 - 1. Backbone, Strands per Cable: 12.
 - 2. Dimensions: 62.5-micrometer core diameter; 125-micrometer cladding diameter.
 - 3. Maximum Attenuation: Minus 3.75 dB/km at 850 nm; minus 1.5 dB/km at 1300 nm.
 - 4. Minimum Modal Bandwidth: 160 MHz/km at 850 nm; 500 MHz/km at 1300 nm.
 - 5. Operating Temperature Range: Minus 20 to plus 70-deg. C.
- B. Raceway: Route all cables in innerduct within conduit.
- C. Cable Connectors: Quick-connect, simplex- and duplex-type SC couplers with self-centering, axial alignment mechanisms. Insertion loss not more than 0.7 dB.
- D. Patch Panel: Modular panels housing multiple-numbered, duplex cable connectors.
 - 1. Permanent Connection: Permanently connect one end of each connector module to installed cable fiber.
 - 2. Mounting: Rack.
- E. Patch Cords: Dual fiber cables in 36-inch lengths.
 - 1. Terminations: Two duplex connectors arranged to mate with patch-panel connectors, one at each end of each fiber in cord.

2.06 IDENTIFICATION PRODUCTS

- A. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TELECOMMUNICATIONS WIRING CLOSET

- A. The wiring closet is generally considered to be a floor serving facility. EDA TELE RM. #123 and HOC ELEC RM #109 are provided in each space. Within the telecommunication rooms the horizontal cross-links the horizontal subsystem and the backbone subsystem together.
- B. The Horizontal Cross-connect shall consist of rack-mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect centers or fiber management panels/trays for the termination of optical fibers.
- C. Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.
- D. The telecommunications room/closet shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- E. Separation from sources of EMI shall be as specified in the TIA/EIA 569-A Pathways and Spaces Standard.
- F. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
- G. The telecommunications closet shall be dedicated to the telecommunications function.
- H. Access to telecommunications closet shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the telecommunications systems or be used for building maintenance services.
- I. Lighting in the telecommunications room/closet shall be a minimum of 500 lx (50 foot candles) at the lowest point of termination. Light switches shall be easily accessible with entering the room.
- J. A minimum of two dedicated duplex or two dedicated simplex electrical outlet, each on a separate circuit, shall be provided for equipment power. Additional convenience duplex outlets shall be placed at 6-foot intervals around the perimeter walls.

3.03 APPLICATION OF MEDIA

- A. Backbone Cable for Data Service: Use 62.5/125 Fm multimode fiber-optic cable for runs between equipment rooms and wiring closets and the main equipment room.
- B. Backbone Cable for Voice Service: Use 4-pair 100 Ohm unshielded / screened twisted-pair, 100 Ohm UTP multi-pair copper cables for runs between wiring closets and for runs between wiring closets and the main equipment room.
- C. Horizontal Cable for Data Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

- D. Horizontal Cable for Voice Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

3.04 INSTALLATION

- A. Wiring Method: Install wiring and optical fiber in raceway and cable tray except within consoles, cabinets, desks and counters. Conceal raceway and wiring except in unfinished spaces.
- B. Install cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- C. Install cables without damaging conductors, shield, or jacket.
- D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
 - 1. Pull cables simultaneously if more than one is being installed in same raceway.
 - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
 - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
- G. Secure and support cables at intervals not exceeding 30-inches and not more than 6-inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to retrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- I. Separation of Wires: comply with TIA/EIA 569-A rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.
- J. Make splices, taps, and terminations only at indicated outlets, terminals and cross-connect and patch panels.
- K. Use splice and tape connectors compatible with media types.
- L. All horizontal cables, regardless of media type, shall not exceed 295 feet from the telecommunications outlets in the work area to the horizontal cross connect.
- M. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room/closet and the work area shall not exceed 33-feet unless used in conjunction with a multi-user telecommunications outlet.

- N. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
- O. Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than or equal to 480 Vrms, shall be installed with a minimum clearance of 2-inches.
- P. The installation of telecommunications cabling shall maintain a minimum clearance of 10-feet from power cables in excess of 480 Vrms. No telecommunications cross-connects shall be physically located within 20-feet of electrical distribution panels, step down devices, or transformers, which carry voltages in excess of 480 Vrms.
- Q. For voice or data applications, 4-pair UTP or fiber optic cables shall be run using a star topology from the telecommunications room/closet serving that floor to every individual information outlet. The Owner shall approve all cable routes prior to installation.
- R. Observe the bending radius and pulling strength requirements of the 4-pair UTP and fiber optic cable during handling and installation.
- S. Each run of UTP cable between horizontal portion of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.
- T. Continuous conduit runs installed by the Contractor shall not exceed 100-feet or contain more than two 90-degree bends without utilizing appropriately sized pull boxes.
- U. Tie wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points.
- V. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- W. Hook and loop cable managers shall be used in spaces where reconfiguration of cables and terminations may be frequent.
- X. Cable ties shall rotate carefully 360-degrees when applied correctly.

3.05 GROUNDING

- A. Comply with Division 16.
- B. Ground cable shields, drain connectors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Bond shields and drain conductors to ground at only one point in each circuit.
- D. Signal Ground Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
- E. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.
- F. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.06 INSTALLATION IN WIRING CLOSETS

- A. Install plywood backboards on walls of equipment rooms and wiring closets from floor to ceiling.
- B. Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.
- C. Group connecting hardware for cables into separate logical fields.
- D. Use patch panels to terminate cables entering the space, unless otherwise indicated.

3.07 INSTALLATION STANDARDS

- A. Comply with requirements in TIA/EIA 568-A and TIA/EIA 569-A.

3.08 IDENTIFICATION

- A. System: Use a unique, three-syllable, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.
 - 1. First syllable identifies and locates equipment room or wiring closet where cables originate.
 - 2. Second syllable identifies and locates cross-connect- or patch-panel field in which cables terminate.
 - 3. Third syllable designates type of media (copper or fiber) and position occupied by cable pairs or fibers in field.
- B. Workstation: Label cables within outlet boxes.
- C. Distribution Racks and Frames: Label each unit and field within that unit.
- D. Within Connector Fields in Main Equipment Room and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Cables, General: Label each cable within 4-inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
- F. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15-feet.
- G. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.
- H. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA 606. Furnish electronic record of all drawings, in software and format selected by Owner.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
 - 2. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA TSB67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA 568-A.
 - 3. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
- D. Remove malfunctioning units, replace with new units, and retest as specified.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets.

END OF SECTION