PROJECT MANUAL

FOR

Relocation of (1) Portable Classroom from Santana High to Telesis Academy

CO-AR Project No. 201904

Prepared for

Rowland Unified School District
1830 Nogales Street
Rowland Heights, CA 91792

August 24, 2023

CO-AR Design, Inc.
680 Brea Canyon Rd. Suite 178, Diamond Bar, CA 91789

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-123646 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 12/07/2023

DSA Approval

LICENSED ARCHITECT
DENNIS JOON HO LEE
C-29168
4 / 30 / 2025
RENEWAL DATE
STATE OF CALIFORNIA

Dennis J. Lee - Architect
License No. C-29168

REGISTERED PROFESSIONAL ENGINEER
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Mel Anthony Fajardo, P.E.
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SPECIFICATIONS

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D. Contractor Use of Site and Premises

E. Work Sequence.

F. Owner Occupancy.

1.02 Work Included:

A. The scope of work outlined below is a summary of the work to be performed and executed by the contractor. For complete detail of the scope of work refer to all parts of the construction/bid documents including the following, plans, specifications and all the codes and standards referred to in the bid documents and governed by local standards. In short, the work will comprise, but not be limited to:

(a) Relocation of one (1) modular classroom building from existing location to Telesis Academy and installing a new fire hydrant as indicated in drawings.

1.03 Work by Owner:

A. The Owner will award a contract which will commence on the owner's notice to proceed. Work under this contract includes:

1. Base Bid

2. Any alternate bid item accepted by the District

B. Items noted "NIC" (Not in Contract) will be furnished and installed by Owner.

C. Owner will retain possession of the following items prior to start of work:

1. Any demolition item identified by Owner

D. Contractor will remove, protect, and deliver items for Owner to take possession of the following items prior to start of work:

1. Any existing item identified by Owner.

1.04 Owner Furnished Products:

A. Items noted "OFCI" (Owner-Furnished Contractor Installed) will be furnished by Owner and installed by Contractor.

B. Items noted "OFOI" (Owner-Furnished Owner Installed) will be furnished by Owner and installed by Owner.

C. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples to Contractor.

2. Arrange and pay for OFCI Product delivery to site.

3. On delivery, inspect Products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturer's warranties, inspections, and service.

D. Contractor's Responsibilities:

1. Review Owner reviewed Shop Drawings, Product Data, and Samples.

2. Receive and upload Products at site; inspect for completeness or damage, jointly with Owner.

3. Handle, store, install, and finish Products.

4. Repair or replace items damaged after receipt.

E. Products furnished and installed by Owner (OFOI):

1. (None)

F. Items furnished by Owner for installation by Contractor (OFCI):

1. (None)

1.05 Contractor Use of Site and Premises:

A. Limit use of site and premises to allow:

1. Owner occupancy.

2. Complete school site use by students and District personnel.

3. Work by others and Work by Owner.

B. Construction Operations: Limited to area as permitted by Owner.

1.06 Work Sequence:

A. Construct work in phases to accommodate Owner's occupancy requirements during the construction period; coordinate construction schedule and operations with Owner or his designated project representative.

1.07 Owner Occupancy:

A. The Owner will occupy the site premises during entire period of construction, for the conduct of his normal operations.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

C. Schedule work to accommodate Owner occupancy.

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION

SECTION 01 20 00

PRELIMINARY WORK

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Furnish, install and do all preliminary work as shown on the drawings and as specified in this section, including but not limited to the following:

1. All site work including all field engineering as indicated on drawings and as required for the completion of the project.

1.02 Examination of Site and the Contract Documents:

A. Before submitting a bid, the bidders shall carefully examine the contract documents, shall visit the site, and shall fully inform themselves as to all existing conditions and limitations and shall include in their proposal a sum to cover all items included in the contract documents.

1.03 Layout of Work:

A. Contractor shall notify the Architect at least three (3) days prior to layout of the work if additional data will be required.

B. Location and elevations of all structures to be constructed under this contract are shown on the drawings and unless any discrepancies therein are brought in writing, to the attention of the Architect prior to beginning of construction, Contractor will be held responsible for the proper locations and elevations as shown and as intended.

C. Contractor shall layout the work and shall establish and maintain necessary markers, auxiliary benchmarks, stakes and batter boards, and shall be responsible for the accuracy of same.

D. Contractor shall layout, as a guide to all trades and to his subcontractors, the exact locations of all walls, partitions, floors, ceiling, doors, windows, and openings.

1.04 Scaffolding and Temporary Construction:

A. Provide temporary construction such as scaffolding, stairs, hoists and similar structures as required for all trades. Employ and pay for a licensed engineer to design and supervise temporary structures including bracing, shoring, crane capacity, crane support, scaffolding and similar construction. Visits to the site by Architect or Structural Engineer shall not include inspection or certification of these items.

1.05 Barricades:

A. The Contractor shall construct and maintain for the duration of the contract an effective barricade around the perimeter of all work in progress subject to governing agency approval. The barricade shall be rigidly constructed of chain link fencing, plywood, or other effective materials, a minimum of 6 feet high.

1.06 Temporary Heating:

A. The Contractor shall provide heat, fuel, and services necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and materials in the contract, unless the buildings are fully occupied by the Owner prior to such acceptance in which case the Owner shall assume all expenses of heating from date of occupancy. The Contractor shall provide heat as follows:

1. At all times during the placing, setting, and curing of concrete, provide sufficient heat to ensure the heating of the spaces involved to not less than 50 degrees Fahrenheit.

2. From the beginning of the application of plaster and during the setting and curing period, provide sufficient heat to produce a temperature in the spaces involved not less than 50 degrees Fahrenheit.

3. For a period of ten (10) days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until full occupancy by the Owner, provide sufficient heat to produce a temperature of not less than 65 degrees Fahrenheit.

1.07 Interruption of Services:

A. The Contractor shall coordinate the work of the several trades to keep the interruption of services, particularly water, gas, electric, sewer, etc., to a minimum. Where possible, changes in utility service shall be made when office areas are not in use (before or after office hours or on weekend days). Should it be necessary to interrupt services while office areas are in use, the Contractor is required to give the Owner 48 hours written notice, and it is required that such interruption be limited to 60 minutes maximum time per day for each utility service interrupted. If additional time is required, arrangements must be mutually agreed upon in advance.

PART 2 - PRODUCTS

2.01 Not Used.

PART 3 - EXECUTION

3.01 Not Used.

END OF SECTION

SECTION 01 25 00

PRODUCT OPTIONS AND SUBSTITUTIONS

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Product options.

B. Substitutions.

1.02 DEFINITIONS

A. Requests for changes in products, materials, or equipment required by Contract Documents proposed by the Contractor prior to and after award of the Contract are considered requests for substitutions. The following are not considered substitutions:

1. Revisions to Contract Documents requested by the Owner or Architect.

2. Specified options of products, materials, and equipment included in Contract Documents.

1.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with Provision for Substitution: Products of manufacturers named and meeting specifications with substitution of products or manufacturer only when submitted under provisions of this section.

C. Products Specified by Naming One or More Manufacturers without Provision for Substitution: No substitution allowed.

1.04 LIMITATIONS ON SUBSTITUTIONS SUBMITTED PRIOR TO THE RECEIPT OF BIDS

A. The Bid shall be based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.

B. Architect may consider requests for substitutions of specified equipment and/or materials only when requests are received by Architect a minimum of 21 days prior to the date established for the receipt of bids.

C. Consideration by Architect of a substitution request will be made only if request is made in strict

conformance with provisions of this section.

D. Burden of proof of merit of requested substitution is the responsibility of the entity requesting the substitution.

E. It is the sole responsibility of the entity requesting the substitution to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.

F. Architect's decision on substitution requests are final and do not require documentation or justification.

G. When substitution is not accepted, provide specified product.

H. Substitute products shall not be included within the bid without written acceptance by Addendum.

1.05 LIMITATIONS ON SUBSTITUTIONS SUBMITTED AFTER THE AWARD OF THE CONTRACT

A. The Contract is based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.

B. Consideration by Architect of substitution requests received after the established date of the receipt of bids or contract award will only be made when one or more of the following conditions are met and documented:

1. Specified item fails to comply with regulatory requirements.

2. Specified item has been discontinued.

3. Specified item, through no fault of the Contractor, is unavailable in the time frame required to meet project schedule.

4. Specified item, through subsequent information disclosure, will not perform properly or fit in designated space.

5. Manufacturer declares specified product to be unsuitable for use intended or refuses to warrant installation of product.

6. Substitution would be, in the sole judgement of the Architect, a substantial benefit to the Owner in terms of cost, time, energy conservation, or other consideration of merit.

C. Notwithstanding the provisions of Article 1.4 of this section and the above, the Architect may consider a substitution request after the date of the receipt of bids or contract award, if in the sole discretion of the Architect, there appears to be just cause for such a request. The acceptance of such a late request does not waive any other requirement as stated herein.

D. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.

E. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without separate written request as required by provisions of this section.

F. Review of shop drawings does not constitute acceptance of substitutions indicated or implied on shop drawings.

G. Substitutions will not be considered when requested or submitted directly by subcontractor or supplier.

H. Substitutions will not be considered as a result of the failure to pursue the work promptly or coordinate activities properly.

I. Burden of proof of merit of requested substitution is the responsibility of the Contractor.

J. It is the sole responsibility of the Contractor to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.

K. Owner shall receive full benefit of any cost reduction as a result of any request for substitution.

L. Architect's decision on substitution requests is final and does not require documentation or justification.

M. When substitution is not accepted, provide specified product.

N. Substitute products shall not be ordered or installed without written acceptance.

1.06 REGULATORY REQUIREMENTS

A. It shall be the responsibility of the entity requesting the substitution to obtain all regulatory approvals required for proposed substitutions.

B. All regulatory approvals shall be obtained for proposed substitutions prior to submittal of substitution request to Architect.

C. All costs incurred by the Owner in obtaining regulatory approvals for proposed substitutions to include the costs of the Architect and any authority having jurisdiction over the project shall be reimbursed to the Owner. Costs of these services shall be reimbursed regardless of final acceptance or rejection of substitution.

D. Substitutions of materials or work procedures which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) field representative.

1.07 SUBSTITUTION REPRESENTATION

A. In submitting a request for substitution, the entity requesting the substitution makes the representation that he or she:

1. Has investigated the proposed substitution and has determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty or guarantee for the substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to the Owner.

4. Waives claims for additional cost or time extension which may subsequently become apparent.

5. Will reimburse Owner for the cost of Architect's review or redesign services associated with substitution request.

1.08 SUBMITTAL PROCEDURE

A. Submit six copies of each request.

B. Submit request with Architect's Substitution Request Form. Form may be obtained at the office of the Architect. Substitution requests received without request form will be returned unreviewed.

C. Limit each request to one proposed substitution.

D. Request to include sufficient data so that direct comparison of proposed substitution can be made.

E. Provide complete documentation for each request. Documentation shall include the following information, as appropriate, as a minimum:

1. Statement of cause for substitution request.

2. Identify product by specification section and article number.

3. Provide manufacturer's name, address, and phone number. List fabricators, suppliers, and installers as appropriate.

4. List similar projects where proposed substitution has been used, dates of installation and names of Architect and Owner.

5. List availability of maintenance services and replacement materials.

6. Documented or confirmation of regulatory approval.

7. Product data, including drawings and descriptions of products.

8. Fabrication and installation procedures.

9. Samples of proposed substitutions.

10. Itemized comparison of significant qualities of the proposed substitution with those of the product specified. Significant qualities may include size, weight, durability, performance requirements and visual effects.

11. Coordination information, including a list of changes or modifications needed to other items of work that will become necessary to accommodate proposed substitution.

12. Statement on the substitutions effect on the construction schedule.

13. Cost information including a proposal of the net change, if any, in the Contract sum if the substitution is submitted after the receipt of bids or contract award.

14. Certification that the substitution is equal to or better in every respect to that required by the Contract Documents and that substitution will perform adequately in the application intended.

15. Waiver of right to additional payment or time that may subsequently become necessary because of failure of substitution to perform adequately.

F. Inadequate warranty, vagueness of submittal, failure to meet specified requirements, or submittal of insufficient data will be cause for rejection of substitution request.

1.09 ARCHITECT'S REVIEW

A. Within 14 days of receipt of request for substitution, the Architect will accept or reject proposed substitution.

B. If a decision on a substitution cannot be made within the time allocated, the product specified shall be used.

C. There shall be no claim for additional time for review of proposed substitutions.

D. Final acceptance of a substitution submitted prior to the date established for the receipt of bids will be in the form of an addendum.

E. Final acceptance of a substitution submitted after the award of the contract will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 Not Used.

PART 3 - EXECUTION

3.01 Not Used.

END OF SECTION

SECTION 01 32 16

PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 Definitions:

A. Day: As used throughout the Contract, the work "day" means "calendar day" unless otherwise indicated.

B. Adverse weather that is normal for the area and the season shall be taken into account in the Construction Schedule.

1.02 Quality Assurance:

A. Reliance Upon Published Schedule.

1. The published schedule, as accepted, shall be an integral part of the contract and will establish interim Contract completion dates for various activities.

2. Should any activity fail to be completed within five (5) days after the stipulated schedule date, the Owner shall reserve the right to order the contractor to submit a detailed recovery schedule showing all recovery dates and durations to fully recover the schedule.

3. Should any activity fail to be completed within 10 days after the stipulated schedule date, the Owner shall have the right to order the Contractor to expedite completion of the activity by whatever means the Owner deems appropriate and necessary, without additional compensation to the Contractor, and as set forth in the General Conditions of the contract.

4. Should any activity fail behind schedule, the Owner shall have the right to perform the activity or have the activity performed by whatever method the Owner may deem appropriate, and as set forth in the General Conditions of the Contract.

5. Cost incurred by the Owner in connection with expediting construction shall be deducted from the Contract amount.

6. Failure by the Owner to exercise the option to either order the Contractor to expedite an activity or to expedite the activity by other means, will not be considered a precedent for any other activities nor a waiver of the Owner's rights to exercise his rights on subsequent occasions.

PART 2 - PART 2 - PRODUCTS

2.01 (Not used)

PART 3 - PART 3 - EXECUTION

3.01 (Not used)

END OF SECTION

SECTION 01 33 00

SUBMITTAL

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Proposed Products list.

C. Shop drawings.

D. Product data.

E. Samples.

F. Manufacturers' instructions.

G. Manufacturers' certificates.

H. Submittal schedule.

I. Deferred approval requirements (for school projects only).

1.02 SUBMITTAL PROCEDURES

A. Transmit each submittal in conformance with requirements of this section.

B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.

C. Identify Project and Architect's project number, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittal without Contractor's stamp and signature will be returned without review.

E. Schedule submittal to expedite the Project, and deliver to Architect at 680 Brea Canyon Road, Suite 178, Diamond Bar, CA 91789. Coordinate submission of related items.

F. Make submittal in groups containing associated and related items to make sure that information is available for checking each item when it is received. Submittal for all items requiring color selection must be received before any will be approved.

G. Architect reserves the right to withhold action on a submittal requiring coordination with other submittal until all related submittals are received.

H. Make submittals far enough in advance of scheduled dates for installation to provide time for review and possible revisions and re-submission prior to approval and subsequent placement of orders.

I. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

J. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

K. Provide space for Contractor and Architect review stamps.

L. Revise and resubmit submittals as required, identify all changes made since previous submittal.

M. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

N. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.

1.03 PROPOSED PRODUCTS LIST

A. Within 14 days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.04 SHOP DRAWINGS

A. Submit required copies (but not less than four) of each drawing. Review comments will be shown on the returned copies and contractor may make and distribute such copies as are required for his/her corrective action and other uses for the project.

B. After review, distribute in accordance with article on procedures above and for Record Documents described in Section 01 70 00 - Contract Closeout.

C. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings. Standard information prepared without specific reference to the project is not to be considered as shop drawing.

D. Do not use or allow others to use shop drawings which have been submitted prior and/or have been rejected.

1.05 PRODUCT DATA

A. When specified in individual specification sections, submit six copies of data for each product which Contractor requires. Four copies will be retained by Architect.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, distribute in accordance with article on procedures above and provide copies for Record Documents described in Section 01 70 00 - Contract Closeout.

1.06 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Provide materials and products specified in the full range of color, texture and pattern for selection by Architect. Range shall include standard stocked color/texture/pattern, standard color/texture/pattern not stocked, but available from manufacturer, and special color/ texture/pattern available from manufacturer as advertised in product data and brochures. Unless otherwise indicated in individual specification sections, Architect may select from any range at no additional cost to Owner.

C. Include identification on each sample, with full Project information.

D. Submit the number of samples which Contractor requires, plus two which will be retained by Architect.

E. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

1.07 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.08 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturers' certificate to Architect for review, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product but must be acceptable to Architect.

PART 2 - PRODUCTS

2.01 (Not Used)

PART 3 - EXECUTION

3.01 SUBMITTAL SCHEDULE

SUBMITTAL SCHEDULE

Spec. Section	Title	Sample *	Product Data/ Catalog Cut Sheet	Shop Drawing and/or Schedule
03 30 00	Cast-in-place Concrete		6	
06 41 00	Architectural Wood Casework			4
09 65 16	Resilient Flooring	2	4	4
10 14 00	Signage	2	6	6
12 36 61	Simulated Stone Countertops	2	4	4

* Contractor shall expedite submittals of Finish Samples material for Architect's "Color and Material Board". Color board related items will not be approved until **all** such items are received by Architect. Additional material or product samples, as determined by architect, may be required for design quality assurance. Contractor shall provide material samples for all such requests at no cost.

Contractor shall coordinate all interior finishes with proper preparation of the substrate as required by the manufacturer, trade industry standard, and perform in a workman-like manner or a combination of the aforementioned requirements, whichever are more stringent.

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

&	AND
/___	ANGLE
@	AT
CL	CENTERLINE
	DIAMETER OR ROUND
__|__	PERPENDICULAR
#	POUND OR NUMBER
(E)	EXISTING
(N)	NEW
A.B.	ANCHOR BOLT
A.C.	ASPHALTIC CONCRETE
ACOUS.	ACOUSTICAL
A.D.	AREA DRAIN
ADDN.	ADDITION
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISHED FLOOR
AGGR.	AGGREGATE
AL.	ALUMINUM
ALT.	ALTERNATE
APPROX.	APPROXIMATE
ARCH	ARCHITECTURAL
ASPH.	ASPHALT
AVE.	AVENUE
AWS	ARCHITECTURAL WOODWORK STANDARDS
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BLKG.	BLOCKING
B.M.	BENCH MARK
BM.	BEAM
BOT.	BOTTOM
BTWN.	BETWEEN
B.W.	BOTH WAYS
CAB.	CABINET
C.B.	CATCH BASIN
CEM.	CEMENT
CER.	CERAMIC
CH.BD.	CHALKBOARD
C.I.	CAST IRON
CLG.	CEILING
CLO.	CLOSET
CLR.	CLEAR
C.M.U.	CONCRETE MASONRY UNIT
CNTR.	COUNTER
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CORR.	CORRIDOR
C.T.	CERAMIC TILE
CPT.	CARPET
CTR.	CENTER
CTSK.	COUNTERSUNK
DBL.	DOUBLE
DEPT.	DEPARTMENT
DET.	DETAIL
D.F.	DRINKING FOUNTAIN
DIA.	DIAMETER
DIAG.	DIAGONAL
DIM.	DIMENSION
DISP.	DISPENSER
D.O.	DOOR OPENING
DR.	DOOR
DS.	DOWNSPOUT
D.S.P.	DRY STANDPIPE
D.T.J.	DEEP TOOLED JOINT
DWG.	DRAWING
DWR.	DRAWER
E.	EAST
EA.	EACH
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRICAL
EMER.	EMERGENCY
ENCL.	ENCLOSURE
E.P.	ELECTRICAL PANELBOARD
EQ.	EQUAL
EQPT.	EQUIPMENT
EXP.	EXPANSION
EXPO.	EXPOSED
EXT.	EXTERIOR
E.W.C.	ELECTRIC WATER COOLER

F.A.	FIRE ALARM
F.D.	FLOOR DRAIN
FDN.	FOUNDATION
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
F.F.	FINISH FLOOR
F.H.	FIRE HYDRANT
F.H.C.	FIRE HOSE CABINET
F.O.M.	FACE OF MASONRY
F.O.S.	FACE OF STUDS
FPRF.	FIREPROOF
F.S.	FLOOR SINK
FT.	FOOT OR FEET
FTG.	FOOTING
FURR.	FURRING
FUT.	FUTURE
GA.	GAGE
GALV.	GALVANIZED
G.B.	GRAB BAR
G.I.	GALVANIZED IRON
GL.	GLASS
GND.	GROUND
GR.	GRADE
GYP.	GYPSUM
GYP. WBD.	GYPSUM WALLBOARD
H.B.	HOSE BIBB
H.C.	HOLLOW CORE
H.D./HD	HEAVY DUTY
HDW.	HARDWARE
HDWD.	HARDWOOD
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HR.	HOUR
HT.	HEIGHT
IC.	INTERCOM
I.D.	INSIDE DIAMETER (DIM.)
INSUL.	INSULATION
INT.	INTERIOR
INV.	INVERT
ISA	INTERNATIONAL SYMBOL OF ACCESSIBILITY
JAN.	JANITOR
JT.	JOINT
F.H.M.S.	FLAT MACHINE SCREW
F.H.W.S.	FLAT HEAD WOOD SCREW
FIN.	FINISH
FIX.	FIXTURE
F.L.	FLOW LINE
FLASH.	FLASHING
FLR.	FLOOR
FLUOR.	FLUORESCENT
F.O.C.	FACE OF CONCRETE
F.O.F.	FACE OF FINISH
KIT.	KITCHEN
KO.	KNOCKOUT
LAB.	LABORATORY
LAM.	LAMINATE or LAMINATED
LAV.	LAVATORY
LB.	POUND
L.F.	LINEAR FOOT/FEET
LIB.	LIBRARY
LKR.	LOCKER
MACH.	MACHINE
MATL.	MATERIAL
MAX.	MAXIMUM
MEZZ.	MEZZANINE
M.C.	MEDICINE CABINET
M.D.O.	MEDIUM DENSITY OVERLAY
MECH.	MECHANICAL
MEMB.	MEMBRANE
MFG.	MANUFACTURING
MFR.	MANUFACTURER
MH.	MANHOLE
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MTD.	MOUNTED
MUL.	MULLION
MTL.	METAL
N.	NORTH
NAT.	NATURAL
N.I.C.	NOT IN CONTRACT
NO. or #	NUMBER
NOM.	NOMINAL
N.T.S.	NOT TO SCALE
O.A.	OVERALL
OBS.	OBSCURE

O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER (DIM.)
O.F.C.I.	OWNER FURNISHED - CONTRACTOR INSTALLED
O.F.O.I.	OWNER FURNISHED - OWNER INSTALLED
OFF.	OFFICE
OPNG.	OPENING
OPP.	OPPOSITE
ORG.	ORIGINAL
OSB	ORIENTED STRAND BOARD
PL.	PLATE
P. LAM.	PLASTIC LAMINATE
PLAS.	PLASTER
PLYWD.	PLYWOOD
PNL.	PANEL
POL.	POLISH
PR.	PAIR
PRCST.	PRE-CAST
REFR.	REFRIGERATOR
RGTR.	REGISTER
REINF.	REINFORCED
REQ'D.	REQUIRED
RESIL.	RESILIENT
REV.	REVISE
R.H.M.B.	ROUND HEAD MACHINE BOLT
R.H.W.S.	ROUND HEAD WOOD SCREW
RM.	ROOM
RND.	ROUND
R.O.	ROUND OPENING
RWD.	REDWOOD
S.	SOUTH
S.C.	SOLID CORE
S.C.D.	SEAT COVER DISPENSER
SCHED.	SCHEDULE
S.D.	SOAP DISPENSER
SECT.	SECTION
S.F.	SQUARE FOOT/FEET
SH.	SHELF
SHR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
S.J.	SAWN JOINT
S.M.S.	SHEET METAL SCREW
S.N.D.	SANITARY NAPKIN DISPENSER
P.S.F.	PRE-FINISHED STEEL FRAME
P.S.I.	POUNDS PER SQUARE INCH
PT.	POINT
P.T.D.	PAPER TOWEL DISPENSER
P.T.D./R.	COMBINATION PAPER TOWEL DISPENSER & RECEPTACLE
PTN.	PARTITION
P.T.R.	PAPER TOWEL RECEPTACLE
Q.T.	QUARRY TILE
R.	RISER
RAD.	RADIUS
R.D.	ROOF DRAIN
REF.	REFERENCE
S.N.R.	SANITARY NAPKIN RECEPTACLE
SPEC.	SPECIFICATION
SQ.	SQUARE
S.SK.	SERVICE SINK
SST./S.S.	STAINLESS STEEL
STA.	STATION
STD.	STANDARD
STL.	STEEL
STOR.	STORAGE
STRUCT.	STRUCTURAL
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
T.B.	TOWEL BAR
T.C.	TOP OF CURB
T.C.B.	TOP OF CATCH BASIN
TEL.	TELEPHONE
TER.	TERRAZZO
T.& G.	TONGUE AND GROOVE
THK.	THICK
T.O.C.	TOP OF CONCRETE
T.O.M.	TOP OF MASONRY
T.O.S.	TOP OF STEEL
T.O.P.	TOP OF PLATE/PARAPET
T.P.	TOP OF PAVEMENT
T.P.D.	TOILET PAPER DISPENSER
TRD.	TREAD
T.S.	TOP OF SHEATHING
T.V.	TELEVISION

T.W.	TOP OF WALL
TYP.	TYPICAL
U.C.	UNDER CUT
UG.	UNDERGROUND
UNF.	UNFINISHED
U.N.O.	UNLESS NOTED OTHERWISE
UR.	URINAL
V.C.T.	VINYL COMPOSITION TILES
VENT.	VENTILATE(R)
VERT.	VERTICAL
VEST.	VESTIBULE
V.G.D.F.	VERTICAL GRAIN DOUGLAS FIR
VOL.	VOLUME
W.	WEST
W.I.	WOODWORK INSTITUTE
W/	WITH
W.C.	WATER CLOSET
WD.	WOOD
WDO.	WINDOW
W.H.	WATER HEATER
W/O.	WITHOUT
WP.	WATERPROOFING
W.R.	WATER RESISTANT
WSCT.	WAINSCOT
WT.	WEIGHT
W.W.F.	WELDED WIRE FABRIC

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation.

B. Tolerances.

C. Field samples.

D. Mock-up.

E. Manufacturers' field services and reports.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

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

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 TOLERANCES

A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturer's tolerances. Should manufacturer's tolerance conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.04 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect.

1.05 MOCK-UP

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.

C. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Architect.

1.06 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 15 days of observation to Architect for review.

PART 2 - PRODUCTS

2.01 Not Used

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION REQUIREMENTS

PART 1 - GENERAL

1.01 General:

A. DISTRICT will employ and pay for the services of an Independent Testing Laboratory approved by Division of the State Architect to perform specified Testing.

1. The CONTRACTOR shall cooperate with the Laboratory and shall in no way relieve the CONTRACTOR's obligation to perform the Work of the contract.

2. Employment of the Laboratory shall in no way relieve the CONTRACTOR's obligations to perform the Work of the Contract.

1.02 References:

A. Title 24, Part 2, of the California Code of Regulations (California Building Standard Code.)

B. DSA - Division of the State Architect, Office of Regulation Services, Structural Safety Section.

C. IR - Interpretations of Regulations Manual published by DSA.

D. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

E. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.03 Related Work:

A. Related Requirements in other parts of the Project manual:

1. Inspections and testing required by laws, ordinances, rules, regulations, orders or approval of public authorities: General Conditions.

B. Related Requirements Specified in Other Sections:

1. Certification of Products: The respective section of this Specification.
2. Test, Adjust, and Balance of Equipment: The respective section of this Specification.

3. Laboratory test Required, and Standards for Testing: The respective section of this Specification.

1.04 District Inspector:

A. An Inspector, approved by DSA, employed the by the DISTRICT in accordance with the Requirements of the state of California Code of Regulation, Title 24, will be assigned to the Work. His/her duties are specifically defined in Title 24, Part 1, Section 4-342.

B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the Work at any time. The CONTRACTOR shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the Work shall not relieve the CONTRACTOR from any obligation to fulfill this Contract.

1.05 Qualification of Laboratory:

A. Meet "Recommended Requirements for Independent laboratory Qualification" published by American Council of Independent Laboratories.

B. Comply with requirements of ASTME 329 and ASTM D 3740.

C. Laboratory Staff: Maintain a full-time registered engineer on staff to review services.

D. Testing Equipment: Capable of performing tests required calibrated at reasonable intervals with devices acceptable to the National Bureau of Standards.

E. All testing agency management, laboratory, and field supervisory personnel shall have at least five years of experience in the inspection and testing of work and materials of construction.

F. Testing laboratory shall maintain a current letter of acceptance issued by the Division of the State Architect (DSA) demonstrating that it has met the criteria established by the Division of the State Architect for performance of inspection work and testing of materials. Laboratory to furnish copy of acceptance letter upon request.

1.06 Limitations of Authority of Testing Laboratory:

A. Laboratory is not authorized to:

1. Release, revoke alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the CONTRACTOR.

4. Stop the Work.

1.07 Contractor's Responsibilities:

A. Cooperate with Laboratory personnel and provide access to Work and to manufacturer's operations.

B. Secure and deliver to the Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the Laboratory the preliminary design mix proposed to be used for material mixed which require control by the testing laboratory.

D. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

E. Notify DSA approved Inspector a minimum of 24 hours in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannon be performed after such notice, reimburse DISTRICT for Laboratory personnel and travel expenses incurred due to CONTRACTOR□S negligence.

F. Make arrangements through the DISTRICT□ PROJECT MANAGER and INSPECTOR and pay for additional samples and tests required for the CONTRACTOR□S negligence.

G. Employ and pay for the services of a separate, equally qualified Independent Testing Laboratory to perform additional inspection, sampling and testing required when initial tests indicate Work does not comply with Contract Documents.

H. The DISTRICT shall pay and back charge the CONTRACTOR for additional testing of all failed tests for this project and special testing required which may be required due to any failed test samples.

I. The CONTRACTOR shall pay for all tests and inspections of materials which require testing of material outside of the State for where this project is constructed to included providing travel expenses, lodging expenses, tools or testing devices, etc., for the testing laboratory personnel.

1.08 Owner□s Testing Laboratory Responsibilities:

A. Test samples of mixes submitted by Inspector.

B. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by Architect.

G. Attend preconstruction conferences and progress meetings when requested by Architect.

1.09 Laboratory Reports:

A. After each inspection and test, promptly submit within no more than 14 days of the date of the inspection, or test, one copy of laboratory report to Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and to Contractor. Reports of test results of materials and inspections found not to be in compliance with the requirements of the Contract Documents shall be forwarded immediately to the Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and the Contractor.

B. Include:

1. Date issued,

2. Project title and number,

3. Testing laboratory name, address, and telephone number,

4. Name of project inspector,

5. Date and time of sampling or inspection,

6. Identification of product and Specifications section,

7. Location of sample test in the Project,

8. Type of inspection or test,

9. Date of test,

10. Ambient environment conditions at time of test or sample-taking,

11. Results of tests and interpretation of test results,

12. Professional opinion as to whether tested work is in conformance with Contract Documents,

13. Recommendations on retesting.

14. All tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported.

15. That the material or materials were sampled and tested in accordance with the requirements of Title 24 and with this Specification.

C. Verification of Test Reports: Each testing agency shall submit to the Architect and the Division of the State Architect a verified report in duplicate covering all of the tests which were required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time and at the completion of the project, covering all tests.

1.10 Schedule of Inspections and Tests by Owner's Testing Laboratory:

A. Perform tests and inspections for the following in conformance with the California Building Code, State of California Amendments, Title 24, Part 2, of the California Code of Regulations, and Interpretations of Regulations of the DSA Interpretive Manual.

1. Soils and Foundations (Chapter 18A)

(a) Earth fill compaction - 1705A.6.1, 1803A.5.8

2. Concrete (Chapter 19A)

(a) Materials

(1) Portland Cement Tests - 1913A

(2) Concrete Aggregates - 1903A.6, ACI 318, Section 3.3

(3) Reinforcing Bars - 1913A.2

(b) Concrete Quality

(1) Proportions of Concrete - 1904A.2

(2) Strength Tests of Concrete - 1705A.3

(3) Composition Construction Cores - 1913A.4

(c) NOTE: Strength tests are not required for equipment pads, pipe and conduit cover and minor non-structural concrete, unless noted otherwise.

(d) Concrete Inspection

(1) Job Site Inspection - 1705A.3

(2) Batch Plant or Weighmaster Inspection - 1705A.3.2

(3) Waiver of Batch Plant Inspection and Tests - 1705A.3.3

(4) Reinforcing Bar Welding Inspection - 1705A.2.2.1.2

(e) Anchors in Concrete

(1) Drilled-In-Expansion Bolts or Epoxy-Type Anchors in Concrete - 1916A.8

3. Wood (Chapter 23)

(a) Materials

(1) Lumber and Plywood Grading - 2303.1

(b) Wood Inspection

(1) Timber Connectors - 1705A.5.6

B. Perform additional test required by individual Specification Sections.

1.11 Schedule of Inspections and Tests by Contractor:

A. Plumbing

1. Testing as specified in Division 22 including, but not limited to: Sterilization, soil waste and vent, water piping, source of water, gas piping, downspouts and storm drains.

B. Automatic Fire Sprinklers

1. Testing as specified in Division 22 shall include, but not be limited to: hydrostatic pressure.

C. Heating, Ventilating and Air Conditioning

1. Testing as specified in Division 23 shall include, but not be limited to, Ductwork tests, cooling tower test, boiler tests, controls testing, piping tests, water and air systems, and test and balance of heating and air conditioning systems.

D. Electrical

1. Testing as specified in Division 26, including, but not limited to, Equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.12 Inspection by the Owner:

A. An Inspector employed by the Owner in accordance with the requirement of State of California Code of Regulations Title 24, Part 1 will be assigned to the work. Duties of Inspector are specifically defined in

Chapter 4, Article 1, Section 4-211 of Title 24, Part 1.

B. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.

C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract. The presence of an Inspector shall in no way change, mitigate or alleviate the responsibility of the Contractor.

D. The Inspector is not authorized to change, revoke, alter, enlarge or decrease in any way any requirement of the Contract Documents, drawings, specifications or subsequent change orders.

E. Whenever there is insufficient evidence of compliance with any of the provisions of Title 24, Part 2 of the California Code of Regulations or evidence that any material or construction does not conform to the requirements of Title 24, Part 2 of the California Code of Regulations, the Division of the State Architect may require tests as proof of compliance. Test methods shall be as specified herein or by other recognized and accepted testing methods determined by the Division of the State Architect. All tests shall be performed by a testing laboratory accepted by the Division of the State Architect.

PART 2 - PRODUCTS

2.01 (Not Used)

PART 3 - EXECUTION

3.01 (Not Used)

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 SECTION INCLUDES

1. Requirements and limitations for cutting and patching of Work.

1.02 SUBMITTAL

A. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.

2. Integrity of weather-exposed or moisture-resistant element.

3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight exposed elements.

5. Work of Owner or separate contractor.

B. Include in request:

1. Identification of Project.

2. Location and description of affected work.

3. Necessity for cutting or alteration.

4. Description of proposed work, and Products to be used.

5. Alternatives to cutting and patching.

6. Effect on work of Owner or separate contractor.

7. Written permission of affected separate contractor.

8. Date and time work will be executed.

PART 2 - PRODUCTS

2.01 MATERIALS

1. Primary Products: Those required for original installation.

2. Substitutions: Under provisions of Section 01 25 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work.

3.03 3.03 CUTTING AND PATCHING

A. Execute cutting, fitting, and patching to complete Work.

B. Fit Products together, to integrate with other work.

C. Uncover work to install ill-timed work.

D. Remove and replace defective or non-conforming work.

E. Remove samples of installed work for testing when requested.

F. Provide openings in the Work for penetration of mechanical and electrical work.

G. Cut rigid materials using saw or drill. Pneumatic tools are not allowed without prior approval.

H. Cut concrete or wall finish material at the nearest existing joints, but not less than area shown, unless noted otherwise.

3.04 PERFORMANCE

A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

B. Employ skilled and experienced installer to perform cutting and patching.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new Products in accordance with requirements of Contract Documents.

E. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 77 00

CONTRACT CLOSEOUT

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.

B. Final Cleaning.

C. Adjusting.

D. Demonstration and Instructions.

E. Project Record Documents.

F. Operation and Maintenance Data.

G. Warranties.

H. Spare Parts and Maintenance Materials.

1.02 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's inspection.

B. Provide submittal to Architect that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.03 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

H. Re-lamp all lighting fixtures.

1.04 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.05 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of final inspection.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work in contrasting color.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product Section in contrasting color ink, description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.

2. Changes made by Addenda and Modifications.

E. Contract Drawings and Shop Drawings: Legibly mark each item in contrasting color ink to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

3. Field changes of dimension and detail.

4. Details not on original Contract Drawings.

F. Submit documents to Architect for final Application for Payment.

1.07 OPERATION AND MAINTENANCE DATA

A. Provide data for:
1. Any architectural equipment, such as operable wall/panel, video screen, electrical blinds, windows, etc.

2. Mechanical Equipment and Controls - Division 23.

3. Electrical System - Division 26.

4. Security System - Division 26.

B. Submit two sets prior to final inspection, bound in 8-1/2-inch x 11-inch text pages, three ring D size binders with durable vinyl covers, and a compact disk or DVD disk containing all pages of the identical documents.

C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

D. Internally subdivide the binder contents with permanent page dividers, logically organized as described

below; with laminated plastic tabs.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

1. Significant design criteria.

2. List of equipment.

3. Parts list for each component.

4. Operating instructions.

5. Maintenance instructions for equipment and systems.

6. Maintenance instructions for finishes, including recommended cleaning methods and materials.

G. Part 3: Project documents and certificates, including the following:

1. Shop drawings and product data.

2. Air and water balance reports.

3. Certificates.

4. Photocopies of warranties.

1.08 WARRANTIES

A. Provide duplicate notarized copies.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For Items of Work delayed beyond the date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

F. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.

G. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturer's, and subcontractors required to countersign special warranties with Contractor.

H. When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

I. When work covered by warranty has failed and has been corrected, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.

J. Upon determination that Work covered by warranty has failed, replace or repair Work to an acceptable condition complying with requirements of the Contract Documents.

1.09 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed.

C. Obtain signed receipt for delivery of materials and submit prior to application for final payment.

PART 2 - PRODUCTS

2.01 Not used

PART 3 - EXECUTION

3.01 Not used

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. The work includes, but is not necessarily limited to, the furnishing and installing and removing of forms for all cast-in-place concrete work as shown and noted on the drawings and specified herein.

1. When authorized in writing by Architect, where sides of excavations have been cut neat and accurate to size for placing of concrete directly against the excavation, and where sides of excavations are firm, forms for footings will not be required as hereinafter specified.

1.02 Requirements of Regulatory Agencies:

A. Codes and Standards: The American Concrete Institute's "Guide To Formwork For Concrete," ACI 347.

B. California Building Code 2022 Edition, Volume 2, Section 1905A, are hereby made a part of this specification. All concrete formwork shall conform with the Chapter 19, and requirements of ACI 318 except as modified by Code, and specified otherwise herein.

PART 2 - PRODUCTS

2.01 Materials:

A. Earth Forms: Allowed only when authorized by the Structural Engineer, earth forms may be used for footings only where the soil is firm and stable and the concrete will not be exposed. Where earth forms are to be used, excavations shall be cut neat and accurate to size for placing of concrete directly against the excavation.

B. Boards for Unexposed Concrete, not otherwise scheduled or specified, shall be 6 inches or 8 inches ship-lapped or T. & G. "Standard" grade Douglas fir, conforming to the "Standard Grading and Dressing Rules No. 16," of the West Coast Lumber Inspection Bureau. Boards shall be S4S. Contractor, at his option, may use plywood for forms in lieu of boards. Plywood, if used, shall be "B-B Plyform Class I Exterior" grade, conforming to U.S. Product Standard PS-1, 5/8 inch minimum thickness.

C. Plywood for Exposed Concrete, not otherwise scheduled or specified, shall conform to the following:

1. Exterior Surfaces: "B-B Plyform Class I Exterior" grade plywood conforming to U.S. Product Standard PS 1, 5/8 inch minimum thickness. Each panel shall carry the grade trademark of the American Plywood Association for quality stamp.

D. Framing, Studding and Bracing: "Standard or Construction" grade Douglas fir, rough or S4S,

conforming to the hereinbefore specified Grading and Dressing Rules No. 16.

E. Cold Joints: Standard metal keyed dividers for cold joints, subject to approval of the Architect.

F. Form Ties and Spreaders: Standard metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Inner tie rod shall be left in the concrete when forms are removed. Submit samples and manufacturer's specifications to the Architect for approval before using. No wire ties or wood spreaders will be permitted.

G. Form Anchors and Hangers: Anchors and hangers used for exposed concrete shall not leave exposed metal at surface. Hangers supporting forms from structural steel shall be symmetrically arranged on supporting members to minimize twisting or rotation of member. Penetration of structural steel members will not be permitted.

H. Form Coating: Non-grain raising and non-straining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface. Apply coating of release agent in conformity with Plyform manufacturer's specifications before reinforcing steel is placed.

PART 3 - PART 3 - EXECUTION

3.01 Construction:

A. Earth Forms: Trench earth forms at least 2 inches wider than footing widths shown on drawings. Construct wood edge strips at each side of trench at top to secure reinforcing and prevent trench form sloughing. Form sides of footings where earth sloughs. Earth forms shall be tamped firm and cleaned of all debris and loose material before depositing concrete.

B. Formwork - General: Wood forms shall be constructed of sound material, shall be of the correct shape and dimensions, mortar tight, and of sufficient strength, and so braced and tied together that the movement of men, equipment, materials or placing and vibrating the concrete will not throw them out of line or position. Forms shall be strong enough to maintain their shape under all imposed loads. They shall be so constructed that they may be easily removed without damage to the concrete. Before concrete is placed in any form, the horizontal and vertical position of the form shall be carefully verified, and all inaccuracies corrected. All wedging and bracing shall be completed in advance of placing of concrete.

C. Forms for Exposed (Architectural) Concrete: Plywood panels shall be clean, smooth, uniform in size, and free from damaged edges and holes. Full size (4' x 8') panels shall be used wherever possible. After construction, tape joints of plywood panels to prevent joint protrusions in concrete. Horizontal joints must be level and continuous. All edges of plywood must be backed to prevent separation. Use special care in the forming and stripping of the forms to protect the corners. Form inside corners with mitered boards so that no concrete is placed against form ends.

D. Framing and Bracing: Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood. Framing, bracing, supporting members, and centering shall be of ample size and strength to safely carry, without deflection, all dead and live loads to which forms may be subjected, and shall be spaced sufficiently close to prevent any bulging or sagging of forms. Soffits of all beam forms shall be constructed of 2 inches minimum thick material. concrete out of line, level or plumb will be cause for rejection of the whole work affected. Distribute bracing loads

over base area on which bracing is erected. When placed on ground, protect against undermining or settlement.

E. Tolerances:

1. Variation from plumb in lines and surfaces of walls, and arrises shall not exceed 1/8 inch in 10 feet with maximum "in" and "out" variation occurring in not less than 20 feet.

2. Variation in linear building lines from established position in plan and related position of walls shall not exceed 1/2 inch in any bay of 20 feet of 1 inch in 40 feet or greater length.

3. Variation in cross sectional dimension of thickness of slabs and walls shall not exceed minus 1/4 inch or plus 1/2 inch.

4. Deflection of soffits of openings, and structural slabs shall not exceed 1/8 inch for their entire length.

F. Chamfered Corners: All corners shall be chamfered 3/4 inch, unless shown otherwise on drawings. Provide moldings in forms for all chamfering required.

G. Form Ties: Form ties shall be of sufficient strength and used in sufficient quantities to prevent spreading of the forms. Ties shall be placed at least 1 inch away from the finished surface of the concrete. The use of ties consisting of twisted wire loops will not be permitted. Inner rods shall be left in concrete when forms are stripped. All form ties shall be spaced equidistant and symmetrical and shall line up both vertically and horizontally.

H. Cleanouts and Access Panels: Provide removable cleanout sections or access panels at the bottom of all forms to permit inspection and effective cleaning of loose dirt, debris, and waste material. All forms and surfaces to receive concrete shall be cleaned of all chips, sawdust and other debris and shall be thoroughly blown out with compressed air just before concrete is placed.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints: Construction joints shall be formed as specified in Section 03300-Cast-In-Place Concrete. Provide a surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints. Just prior to subsequent pour, remove strip and tighten forms to conceal shrinkage. Construction joints shall show no "overlapping" of concrete and shall, as closely as possible, present the same appearance as butted plywood joints. Joints in a continuous line shall be straight, true, and sharp.

K. Embedded Items: Provisions shall be made for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features. No wood other than necessary nailing blocks shall be embedded in concrete. Complete cooperation shall be extended suppliers of embedded items in their installation. Secure information for embedded items from other trades as required. All embedded items shall be securely anchored in correct location and alignment prior to placing concrete. Electrical and telephone conduits shall be run in concrete only upon the written approval of the Architect. Under no circumstances will aluminum conduit be permitted in concrete. No electrical or telephone conduit larger than 3/4" in diameter and no plumbing pipes of any size will be permitted in concrete walls or

slabs. No conduit or pipe will be permitted under utility vault.

L. Openings for Items Passing Thru Concrete: Frame openings in concrete where indicated on architectural, structural, plumbing, mechanical or electrical drawings. Contractor shall establish exact location, sizes and other conditions required for openings and attachment of work specified under other sections. Contractor shall be held responsible for proper coordination of all work of this nature in order that there will be no unnecessary cutting and patching of concrete. Any cutting and repairing to concrete required as result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

M. Screeds: Contractor shall set screeds and establish levels for tops of concrete slabs and leveling for finish on slabs. Shape slabs to drain where required or as indicated on drawings. Before depositing concrete, all debris shall be removed from the space to be occupied by the concrete, and forms shall be thoroughly wetted. Reinforcement and inserts shall be secured in position and approved by the Architect. Free-standing water shall be removed.

N. Screed Supports: Screed supports for concrete over waterproof membrane and\or vapor-barrier membranes shall be of a cradle, pad, or base type which will not puncture the membrane. Staking through the membrane will not be permitted.

O. Shores and False Work: Contractor shall be fully responsible for the proper strength, safety, and adequacy of all falsework, supports, posts, footings, etc., used on and in connection with the work. False-work and supports shall be adequate in size and strength to resist the loads imposed upon them without deformation, deflection, or settlement. Wedges in pairs or jacks shall be used where required to bring forms, shoring, or falsework for slabs, and other parts of the structure to the exact elevations and uniform bearing before placing concrete. Single wedges will not be permitted. Vertical and lateral loads shall be carried to ground by formwork system or by completed structure, after it has attained adequate strength. Submit manufacturer's data for patented shores, shore splicing, and methods of shore support. Construct forms to permit their removal without disturbing the original shoring.

P. Reuse and Coating of Forms: Thoroughly clean forms and re-coat with specified form coating before each reuse. Do not reuse any form for exposed work which cannot be reconditioned to "like new" condition. Discard forms considered unsatisfactory by the Architect. Apply form coating to all forms in accordance with the manufacturer's specifications. Apply form coating before placing reinforcing steel.

Q. Inspection: Prior to placing of any concrete, and after placement of reinforcing steel in the forms, Contractor shall notify the Architect so that proper inspection may be made. Such notification shall be made at least 72 hours in advance of placing concrete to permit proper arrangements to be made for inspection.

R. Rejection of Defective Work Due to Improper Forms: Any movement or bellying of forms during construction or variations in excess of the tolerances specified will be considered just cause for the removal of such forms and, in addition, the concrete work so affected. Reconstruction of forms and new concrete shall be furnished at no additional cost to the Owner.

3.02 Removal of Forms and Shores:

A. The supporting forms and shoring shall not be removed until the members have acquired sufficient

strength to support their weight and the loads superimposed thereon until the time and sequence has been approved by the Architect. Earlier removal than specified below may be approved by the Structural Engineer, based on the weather and tests of job-cured cylinders. All formwork shall be removed without damage to the concrete.

B. The minimum time for forms and shoring to remain in place shall be as follows:

C. Formwork, for sides of beams, columns, and parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

D. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place for 14 days or until concrete has achieved the following:

1. At least 75 percent of 28-day design compressive strength.
2. Determine compressive strength of in-place concrete by testing representative field or laboratory-cured test specimens according to ACI 301.
3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

E. Any request for earlier removal of forms and shoring shall be made to the Architect in writing, along with supporting evidence that the safety of the structure will not be impaired.

F. Shoring shall be adequate in strength and shall be so designed and placed that the load from successive parts of the structure will be transmitted directly through the falsework without creating bending or shearing stresses in the concrete. Do not remove shores until supporting members have attained sufficient strength to carry the imposed loads and when approved by the Architect.

G. During the period that forms are in place on the concrete work, said forms shall be kept wet at all times.

H. In removing plywood forms, no metal pinch bars shall be used and special care shall be taken in stripping. Start at top edge of vertical corner where it is possible to insert wooden wedges. Wedging shall be done gradually and shall be accompanied by light tapping on the plywood panels to crack them loose. Do not remove forms with a single jerk after it has been started at one end.

I. Forms shall be left in place as long as possible to permit shrinkage away from concrete, and plywood forms shall be left in place until all other forms around are stripped and until there is no danger of damaging the architectural concrete due to other work in the vicinity.

J. Nothing herein shall be construed as relieving the Contractor of any responsibility for the safety of the structure.

K. After stripping, Contractor shall properly protect all concrete to be exposed in the finish work from damage, with boards and non-staining building paper to prevent staining, spalled edges, chips, etc.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Furnish and install all Concrete Reinforcement as indicated on the drawings and as specified in this section.

1.02 Requirements of Regulatory Agencies:

A. All work shall conform to the latest code requirements and the following Standards:

1. The currently AHJ adopted edition of the California Building Code;
2. Concrete Reinforcing Steel Institute;
3. American Concrete Institute (ACI);
4. ASTM International (ASTM);
5. American Welding Society (AWS);
6. American Institute of Steel Construction (AISC);
7. Concrete Reinforcing Steel Institute (CRSI).

1.03 Tests and Inspections:

A. Inspection of reinforcing steel for size and location prior to placing of concrete shall be done by a full time job inspector employed by the Owner.

B. Test steel reinforcement in accordance with ASTM A-615-40. One test shall be made for each 10 tons or portion thereof where mill analysis is available. Where no identification is available, one test for each 2-1/2 tons or portion thereof shall be made.

C. Payments for Tests and Inspections: See Supplementary General Conditions for method and responsibility for payments for tests and inspections required under this section.

PART 2 - PRODUCTS

2.01 Materials:

A. Billet-steel bars for concrete and/or masonry reinforcement, ASTM A615, Grade 40 for No. 4 & smaller bar, Grade 60 for No. 5 & larger bars. Bars to be welded shall conform to ASTM A706, unless specified on structural drawings.

B. Welding Electrodes: As per AWS D1.1 and Sections 1.17 of AISC Specifications. Electrodes shall be E-70xx type, delivered in hermetically sealed labeled containers.

C. Welded wire fabric for concrete reinforcement shall be not less than 6 x 6 - W1.4 x W1.4 per ASTM A497; unfinished.

2.02 Accessories:

A. Chairs, bolsters, spacers and the like shall be preformed and manufactured for the express use involved. These items shall be plastic coated metal or aluminum when used in slabs or beams with underside to be left exposed, painted or to receive plaster.

B. Concrete blocks approximately 3 inches on a side, or building code approved reinforcement chair, of appropriate height, shall be used to support reinforcement in all concrete poured on ground, fill on ground, and over membrane on ground or fill.

C. Tie wire: Minimum 16 gage annealed type.

D. Chairs, bolsters, bar support, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

E. Special Chairs, Bolsters, bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped steel type; size and shape to meet Project conditions.

F. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit jointed reinforcing with ICC evaluation report.

G. Reinforcing Splicing Devices: Mechanical set screw, swaged, threaded, type; full tension and compression; sized to fit jointed reinforcing with ICC evaluation report.

H. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

PART 3 - PART 3: EXECUTION

3.01 Fabrication:

A. Where possible, all reinforcement steel shall be bent to shape at Contractor's shop. Unless otherwise indicated on drawings, the design and details of the steel shall conform to requirements of the Concrete Reinforcing Steel Institute and the American Concrete Institute.

1. Bars reduced in section will not be accepted.

2. Bars with kinks or bends not shown on drawings will not be accepted. Bars shall not be formed in a manner injurious to bars.

3. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and

seismic hooks as indicated on Drawings.

4. Form reinforcement bends with ACI standard diameters in accordance with structural drawings.

5. Fabricate column reinforcement with offset bends at reinforcement splices.

6. Form spiral column reinforcement from minimum 3/8 inch diameter continuous deformed bar or wire

7. Galvanized, Coated Reinforcement: Clean surfaces, weld re-protect welded joint in accordance with CRSI.

8. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.

B. Bars shall not be heated to facilitate bending or for any other purpose.

3.02 Welding:

A. Perform welding by direct electric arc process, with thoroughly trained and experienced certified operators. Conform all welding to latest edition of AISC Specification for Building and to American Welding Society "Code for Arc and Gas Welding in Building Construction" and “Structural Welding Code - Reinforcing Steel” AWS D1.4.

B. Characteristics of Welds: When brushed with wire brushes, completed welds must exhibit uniform section, smoothness of welded metal, feather and good fusion with penetration into base metal.

C. Inspection: Perform welding, either in shop or field, under continuous inspection of Registered Deputy Inspector (see Section "Testing and Inspections").

3.03 Installation:

A. Before being placed, thoroughly clean all material of all rust, dirt, dust, oil and any other material deleterious to bonding of concrete.

B. Supports: With the exception of temperature reinforcement which shall be tied to main steel approximately 12 inches on center, reinforcement shall be accurately placed and securely tied at all intersections and spliced with 16 gauge black annealed wire, and shall be securely held in position during placing of concrete by means of precast concrete block supports. Wire-tie ends shall point away from the form. Unless otherwise indicated on drawings or specified, the number, type and spacing of supports shall conform to the latest ACI Detailing Manual (ACI 315). Alternative methods of reinforcement supports or tying method shall be subjected to approval by project inspector.

C. Do not displace or damage vapor retarder.

D. Accommodate placement of formed openings.

E. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.

1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

F. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows:

	Reinforcement Location	Minimum Concrete Cover
1.	Footings and Concrete Formed Against Earth	3 inches
2.	Concrete exposed to earth or weather	
3.	No. 6 (19) bars and larger	2 inches
4.	No. 5 (16) bars and smaller	1½ inches
5.	Supported Slabs, Walls, and Joists	
6.	No. 14 (43) bars and larger	1½ inches
7.	No. 11 (36) bars and smaller	¾ inches
8.	Beams and Columns	1½ inches
9.	Shell and Folded Plate members	
10.	No. 6 (19) bars and larger	¾ inches
11.	No. 5 (16) bars and smaller	½ inches

G. In masonry construction reinforcement shall be placed as required. All steel shall be held at least ½ inch clear of the masonry unit to insure acceptable coverage of grout.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Furnish and install all Concrete Work as shown on the drawings and as specified in this section, including but not necessarily limited to, the following:

1. All plain and reinforced concrete.
2. Placement of anchor bolts, nailing strips and embedded fasteners/inserts for other trades.
3. Floor hardener and sealer, and integral color.
4. Coordination of all work with all other related trades as required.

1.02 Requirements of Regulatory Agencies:

A. Except as modified by the requirements specified herein and/or the details on the drawings, all work included in this section shall conform to the applicable provisions of the following codes and standards.

1. California Building Code (CBC), 2022 Edition, Chapter 19A, "Concrete."
2. American Concrete Institute (ACI): Building Code Requirements for Reinforced Concrete, ACI 318.
3. American Society for Testing and Materials (ASTM): The specifications and standards hereinafter referred to the most current edition.

1.03 Tests and Inspections:

A. A Testing Laboratory hired by the Owner shall design mixes for each type and class of concrete.

B. Design mixes shall be submitted to Architect for approval.

C. Owner shall pay for Testing Laboratory service except when a test fails.

D. Owner shall pay for Batch Plant inspection where indicated.

E. Special Concrete Inspection: Special inspection is required for all concrete in excess of 2,500 psi. Cost of special inspection shall be by Owner. Refer to Testing and Inspection section for other requirements.

1.04 Submittals:

A. All submittals shall be in accordance with Section 01 33 00 - Submittals.

B. Submittals shall include, but not necessarily limited to, the following:

1. Mix Designs (All classes)
2. Reinforcement Certifications
3. Batcher/Mixer Slips
4. Delivery Tickets (weightmaster certificate)
5. Test Cylinder Strength Reports

C. Product Data: Submit product data for the following item, as required:

1. Reinforcement
2. Forming Accessories
3. Admixtures
4. Patching Compounds
5. Hardener
6. Joint Systems
7. Curing Compounds
8. Sealants

D. Shop Drawings: Submit shop drawings, when indicated, for fabrication, bending and placement of concrete reinforcement. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap. Include any special reinforcement required for openings through concrete structures.

E. Laboratory Test Reports: Submit concrete materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

PART 2 - PRODUCTS

2.01 Materials:

A. Portland Cement: ASTM Standard Specifications for Portland cement, C-150, Type I or Type II. Use Type V cement when 0.2% or more sulfate content in soil is encountered. Use only one brand of cement on the project. Temperature of cement shall not be over 140 degrees F. when delivered to the batching plant.

B. Concrete Aggregates: ASTM Standard Specifications for Concrete Aggregates, C-33 for standard weight and C-330 for lightweight concrete; Hydrolite, Realite, TXI, Crestlite, Rocklite or approved equal.

C. Water for mixing concrete and grout shall be taken from an approved domestic source and shall be free of all impurities detrimental to concrete.

D. Admixture may be used in all concrete at Contractor's option and shall be Pozzolith. Admixtures shall be approved by the Architect and used in strict conformity with manufacturer's specifications. Color concrete, if required, shall be achieved by using colored concrete as manufactured by Admixtures, Inc. of Monrovia, California (626-357-3263) or accepted equal.

E. Reinforcement Steel per Reinforcement Steel Section 03 20 00.

F. Curing Compounds: Zero-VOC compound in clear solution. Non-membrane forming. Compounds in suspension not permitted. Material shall be compatible with subsequent coatings and toppings without stripping. Acceptable Products:

1. Sinak S-102, Sinak Corp., San Diego, CA.
2. L&M Cure, L&M Construction Chemicals, Omaha, NE.
3. Med-Cure, WR Meadows, Hampshire, IL.

G. Concrete Hardener (if required): Sika-Gard C/H, Aquabar or Hornstone, two impregnations applied as per manufacturer's directions on all exposed interior concrete.

H. Concrete Sealer: Sikagard No.701W, or accepted equal, compliant with current California VOC regulation. Apply two coats of material per manufacturer's printed instruction and/or recommendations on all exposed interior concrete, unless noted otherwise.

I. Forms:
1. Plywood: Douglas Fir APA Exterior BB Grade or better.
2. Framing members (whalers, etc.) No. 1 Grade DF or better.
3. Form ties: Burke "Snap Ties" or accepted equal.

J. Integral color admixture: shall be by Davis Colors in premium series, or accepted equal.

2.02 Concrete Strengths and Proportions:

A. Required strength of concrete shall be as shown on the Structural Drawings.

B. Concrete mixes shall be 3,500 psi at 28 days, if no other structural design is specified.

PART 3 - EXECUTION

3.01 Construction of Forms:

A. Forms shall be substantial, plumb, level, square, true-to-line, watertight and accurate to the dimensions required.

B. Concrete surfaces, where left exposed, shall be formed on all sides with plywood with taped joints to give a smooth, uniform, straight finish.

C. Details of Construction:

1. Reinforcing steel shall be securely tied in place. Do not use bars with kinks or bends not shown on drawings. Reinforcing steel shall be clean, free from rust, oil, scale or any foreign material. Place all reinforcing as detailed and comply with typical details for bends, splices, clearance, etc., and with requirements of the California Building Code.

2. Location of construction joints or expansion joints shall be approved by the Architect prior to work. Do not allow form stakes to penetrate concrete footings.

3. Openings for mechanical and electrical: Provide for and verify all openings in the concrete

with the trade involved. Install all sleeves as may be required.

3.02 Mixing, Placing and Finishing:

A. Mixing of concrete shall be by transit-mixers only in accordance with ASTM C94. Quantities of materials shall be recorded by an authorized weighmaster. Mix concrete for 10 minutes minimum with a peripheral drum speed of approximately 200 feet per minute. At least 3 minutes of the mixing period shall be at the job site. Discharge loads in less than 1-1/2 hours after water is first added.

3.03 Placing of Concrete: Avoid segregation, do tamping and vibrating in such a manner as to produce a dense, smooth job free from rock pockets and voids. Do not place concrete when the temperature is below 40 degrees F. Tremies or other devices shall be used to limit the free fall of concrete to a maximum height of 4 feet. In no case shall concrete be deposited from a height that will cause separation of the aggregates.

A. Finishing (unless otherwise noted): shall be as follows:

1. Floor slabs, all interior work with floor covering: steel trowel finish.

2. Flat work, exterior: medium broom finish (heavy broom finish for ADA accessible ramps.)

B. Variance in concrete slab surface shall be no more than 1/16 inch in 10 feet.

3.04 Embedded Items:

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to received top edge of foundation sheet waterproofing and to receive through-wall flashing in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.05 Curing of Concrete and Removal of Forms:

A. Curing shall be done in such a manner as to produce a complete hydration of the concrete. The responsibility of proper curing will lie with the Contractor. Improperly cured concrete shall be removed and replaced at the expense of the Contractor.

B. Curing may be accomplished by keeping concrete continuously wet by flooding, by covering the concrete with "Visqueen" for 10 days or by using curing compound. Manufacturer of curing compound shall certify that product will not interfere with adhesive/bonding of floor covering or wall finish material used on this project.

C. Exterior walks, curbs, gutters, and other exterior concrete site work may be cured by the use of an approved curing compound applied in strict compliance with the manufacturer's specifications and/or recommendations.

D. Removal of Forms. Do not remove forms until the concrete has attained adequate strength to prevent damage. Take extreme care in stripping to avoid breaking off corners, marking concrete or defacing the finish surface in any way. Minimum stripping time at walls shall be 3 days.

E. The temperature of the concrete shall not be allowed to drop below 40° F anytime during the curing period.

3.06 Cleaning and Patching:

A. After stripping forms, clean all exposed concrete surfaces and all adjoining work stained by leakage of concrete. Remove all fins, burrs and projections by grinding.

B. Patch all voids, rock pockets, holes, cracks, etc., by chipping loose concrete and exposing clean sound aggregate. Structural Engineer and Inspector will inspect all patching preparation prior to dry-packing for approval.

C. After inspection, dampen prepared recesses for 2 hours minimum and fill with dry-pack to within 1/4 inch of surface. Keep dry-pack damp for 2 days minimum.

D. Apply mortar to final surface and keep patch damp for 5 days minimum.

E. Entire surface of concrete to be sacked with neat cement and water after surface is cleaned and patched.

3.07 Defective Concrete:

A. Should concrete tests indicate that the strength is not as specified, or if concrete has excessive pockets, or if reinforcing steel is exposed, or if concrete does not in any way comply with the drawings and specifications, the defective concrete shall be removed and replaced as directed at the Contractor's expense.

3.08 Concrete Curbs and Sidewalks:

A. Concrete Curbs (where required) shall be constructed in place with expansion joints not more than 25 feet apart.

1. Form work shall be approved by the inspector before pouring is started.

2. Expansion joint material shall be equal to Asphalt Expansion Joint Filler manufactured by Sika or W.R. Grace Co., Los Angeles, and shall penetrate and be continuously one piece through the curb.

3. Shapes and sizes of on-site concrete curbs shall be as indicated on the drawings and the concrete shall conform to all applicable conditions of these documents. Concrete shall be placed in such a manner as to prevent distortion of the forms and shall be vibrated as required to insure an acceptable product.

4. As soon as the concrete will allow, strip the forms and trowel smooth the curb face and top. Tool the edges of expansion joints with an approved 1/8 inch edging tool.

5. After curing, the backfill shall be placed. The completed curb shall be protected from damage until work is accepted.

6. Where any curb requires repair before acceptance, the repair shall be made by removing and replacing the entire curb between joints and not by refinishing the damaged portion.

B. Concrete Sidewalks (where required):

1. Concrete sidewalks shall conform to the general provisions of this section and to the appropriate standard drawings by local agency having jurisdiction (AHJ). Unless noted otherwise, all concrete sidewalks shall be not less than four (4) inches thick with 6X6, 10-10 wire fabric.

2. In the construction of sidewalks, the concrete shall be tamped sufficiently to bring the fins to the surface after which it shall be finished to the required grade with appropriate metal or wooden floats, and troweled to a medium broom finish as directed by Architect.

3. When sidewalks and curbs are constructed monolithic, the tip of curb shall be finished same as a sidewalk, except finish shall be in opposite direction.

4. When a straightedge 10 feet long is laid on the surface of the sidewalk, the surface shall not vary more than 1/16 inch from the edge of the straightedge, except at grade changes or curves.

5. Unless otherwise provided, the transverse slope of the surface of sidewalks shall be under 1/4 inch per foot (2%), calculated from the top of the curb to the back of sidewalk.

6. The surface of sidewalks shall be marked into rectangles as control joints, no side of which shall be greater than 60 inches, unless otherwise indicated on drawings. The marking is to be done by saw-cutting the concrete which will leave a groove not less than 1-1/2 inches deep. Edges of sidewalks shall be rounded same as curbs.

7. The Contractor shall repair and clean, at his/her own expense, all concrete damage or discolored during construction. Where any curb requires repair before acceptance, repair shall be made by removing and replacing the entire curb between joints and not by refinishing the damaged portions.

3.09 Sandblasting (where indicated):

A. Sandblast all concrete as indicated on drawings for light, medium, or heavy texture finish. Provide sample panel of sandblast texture, minimum size 4'X4', for approval by Architect before commencement of sandblasting. Architect is to be present, when sandblasting is commenced, to approve or reject method and finish texture.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Work Included:

A. Fabrication and installation of metalwork not specified elsewhere.

B. Shop and field welding, drilling, cutting, connecting.

C. Shop painting.

1.02 Related Work Specified Elsewhere:

A. Cast-In-Place Concrete -- Section 03 30 00: Concrete Embedded Items.

B. Painting -- Section 09 91 00

1.03 Reference Standards:

A. ASTM: American Society for Testing and Materials.

B. AISC: American Institute of Steel Construction.

1.04 Requirements of Regulatory Agencies:

1.05 This specification is based upon quality materials, methods and workmanship as contained in the latest Masonry Codes and Specifications by Masonry Institute of America, Part 1 & 2, Title 24, of the California Building Code (C.B.C.), and the 2022 edition of the California Building Code.

1.06 Submittals:

1.07 Submit shop drawings of work for approval before beginning work on this section. Design members and connections for portions of work not indicated on drawings. Show manner of fabrication of work and size and extent of welds, bolts, etc.

PART 2 - PRODUCTS

2.01 Materials:

A. Structural steel: ASTM, A36.

B. Miscellaneous metals: commercial-quality mild steel.

C. Steel tubing: ASTM, A53, galvanized.

D. Galvanizing: ASTM, A123.

E. Post-setting grout: Non-shrink type as approved by ICC report.

F. Paint: epoxy paint.

G. Primer: approved by Architect.

H. Railings: standard carbon steel, ASTM, A500, unless otherwise noted.

2.02 Fabrication:

A. General:

B. Work shall be shop-fitted and shop-assembled where practicable, as detailed in approved shop drawings. Follow applicable AISC codes and manuals. Finish exposed work smooth with even, close joints and neat connections. Profiles shall be true to detail, clean, straight, and sharply-defined.

C. Preparation: Clean all material before fabrication.

D. Cutting and drilling:

E. Provide holes for fabrication and for attachment of work specified elsewhere. Countersink holes for rivets and screws. Cope pipe railing joints.

F. Priming:

1. Clean all surfaces of grease, rust, and loose mill scale before priming.

2. Prime ferrous metalwork, except work to be galvanized, with one shop coat of primer. Do not prime areas to be welded or embedded in concrete. Where metal is only partially in contact with concrete, entire surface may be painted. Do not prime in wet weather unless material is protected from dampness. Work paint into joints with brush.

G. Isolation of dissimilar metals:

H. Separate dissimilar metals where they come in contact with one another, or with concrete, to prevent galvanic action and/or corrosion. Provide separating material with permanent means of protection.

I. Welding: Weld (continuous) pipe railing joints and grind weld smooth.

J. Painting:

1. Paint surfaces of ferrous metalwork which will be inaccessible after erection.
2. Paint pipe railings, handrail, supports, and steel rungs.

K. Zinc Coating (For all exterior exposed steel, and for interior items indicated to be galvanized): Miscellaneous steel 2.0 ounce per square foot of surface, average with none less than 1.8 ounce per square foot and in conformance with ASTM A-123. Galvanize metal checkered plate covers, gratings and frames, down spouts, down spout guards, and straps.

L. Sizing pipe sleeves: Size pipe sleeves through concrete to provide a space of not less than 1/4" all around between the sleeve and the pipe to be accommodated.

PART 3 - EXECUTION

A. Furnish templates, dimensions, and instructions for setting of embedded items as required in Section 03300.

B. Erect all work plumb, square, and true. Fit accurately with tight joints and intersections. Brace, reinforce, and anchor in place.

C. Repaint damaged areas with shop coat of paint after erection. Clean and paint welded areas. Use same primer and paint as used in shop.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Furnish and install all modular casework and counter tops as indicated on the drawings and as specified herein.

1.02 Submittal:

A. Submit complete Shop Drawings in accordance with the Supplementary General Conditions.

B. Shop Drawings shall show list of materials and hardware, sizes, sections, elevations and joinery details of construction and assembly as required by Section 1, Submittal, of the Architectural Woodwork Standards, 2014 Edition.

C. Shop Drawings shall indicate all grounds, backing, blocking, sleepers and other items required for the installation of casework which are to be furnished and installed as part of the structure by the General Contractor.

D. The Architectural Woodwork Standards Certified Compliance Grade Stamp, indicating the Grade(s) specified, shall be affixed to the casework Shop Drawings, certifying that the casework and counter tops will be manufactured in accordance with the Architectural Woodwork Standards Grade(s) specified.

1.03 Standards and Certification:

A. Before delivery to the job site, each unit of casework and each plastic laminate counter top shall bear the Certified Compliance Grade Stamp for the Grade(s) specified.

B. After casework is installed, the millwork supplier shall issue an Architectural Woodwork Standards Certified Compliance Certificate indicating all casework and plastic laminate counter tops furnished by him for this job sully meet all the requirements of the Grade(s) specified.

C. To assure quality as specified, the Architect or his representative may inspect work in the process of manufacture or the finished casework at contractor□s shop facility prior to delivery.

1.04 General:

A. Protect millwork items against dampness during and after delivery. Wrap and/or store in clean, well-ventilated area where not exposed to extreme changes of temperature and humidity.

B. Field measurements shall be made as required for the work of this section. Report any major discrepancy between the Drawings and field dimensions to the Architect, in writing.

PART 2 - PRODUCTS

2.01 Modular Laminated Plastic Covered Casework: (A.W.S. Section 15)

A. Manufacture casework in accordance with Architectural Woodwork Standards published by Woodwork Institute (W.I.) & Architectural Woodwork Institute (A.W.I.), Laminated Plastic Covered Casework, "Custom" Grade, except as may be modified hereinafter.

B. Casework bodies shall be 3/4" in thickness particle-board. Particle-board shall be a minimum density of 45 pounds and conform to requirements set forth in the Architectural Woodwork Standards Glossary.

C. High Pressure Plastic Laminate: Formica, WilsonArt, Nevamar, or accepted equal, conforming to NEMA LD-3, 80; 0.050" thick for counter tops and work surfaces, and 0.028" thick for other exposed surfaces, including edge bands. Product shall meet Owner's material quality standard if one is available. Colors and patterns shall be as selected by the Architect.

D. Cabinet interiors, including faces and edges of shelving therein, shall be finished with 0.020" thickness high pressure laminate cabinet liner. Interior faces of hinged doors shall be same material as exposed portions.

E. Drawer Boxes: Provide with sub-fronts and applied finish fronts securely fastened. Drawer side shall be Custom Grade 7 or 9 ply hardwood plywood with no voids in the inner ply. Drawer bottoms shall be tempered hardboard. All semi-exposed portions of drawers shall be finished with one coat of sanding sealer and one coat of clear gloss lacquer. Provide all drawers with metal slides except as may be noted otherwise.

F. Shelving shall be 3/4" thickness particle board for spans up to 35" and 1" thickness for spans over 35" up to 47". Shelving hardware shall be adjustable to 1" centers. Faces and edges of shelving shall be finished with 0.020" thickness cabinet liner.

G. Metal Strike Plates: Where locks are indicated, provide cabinet door and drawer locks with metal strike plates to protect against particle board rip-out.

H. Cabinet doors shall be flush overlay, Type F, hinged to swing flat against the face of adjoining casework or the side of the cabinet. Interior faces and edges shall be covered with plastic laminate to match exposed faces. Notch cabinet doors to receive hinges.

I. All unfinished materials used for backs, bases, self-edge backing, stripping and other concealed portions shall be sealed with a water-repellent sealer - Thompson Waterseal Advance Natural Wood Protector, Watco Oil, or accepted equal.

J. Scribe cabinet directly to wall. Do not use scribe moldings or fillers.

2.02 Plastic Laminated Counter tops and Splashes:

A. Counter tops and splashes shall be made in accordance with Architectural Woodwork Standards, Section 16, Laminated Plastic Counter tops and Splashes, "Custom" Grade, except as may be modified hereinafter.

B. High Pressure Plastic Laminate: WilsonArt, Formica, Nevamar, Micarta, or equal, conforming to NEMA LD-3, 80; 0.050" thick. Multiple colors and patterns shall be as selected by the Architect.

C. Backing sheets shall be a minimum of 0.020" thick conforming to NEMA LD-3, 80, and shall be laminated to the underside of all counter tops and back splashes.

D. Core material shall be 3/4" thickness particle board with a minimum density of 45 pounds and conform to requirements set forth in the Architectural Woodwork Standards - Glossary.

E. Construction of Counter tops and Splashes: Counter tops shall be fully formed with rounded corners and end joints. Front edge of counter top shall be a no-drip bullnose type at tops with sinks. Provide self-edge for exposed edges of counter elsewhere, unless noted otherwise.

2.03 Hardware (All colors and/or finishes shall be as selected by architect):

A. Hinges: Blum **94355(free swing)** or **No.95355 (self-closing)**, 110° overlay door 3/4" thick type, satin stainless steel (**BHMA 630**) finish as selected by Architect.

B. Pulls: LAMP by Sugatsune America, Inc. No. XL-JSR100 for doors, No. XL-JSR70 for drawers. Pulls shall be in stainless steel finish **(polished BHMA 629)** or **(satin BHMA 630)** as selected by Architect.

C. Catches: Magnetic, National Lock No. H2-0570-001-8 with strikes or equal for doors with no locks; Federal Specification FF-H-111, Type F-1075-AC for inactive leaf of pairs of doors with locks.

D. Drawer Slides: Full extension with no deflection, □" slide space, 100 pound load capacity as manufactured by Accuride **Model 3832**, Knape & Vogt (K&V) **Model 8400**, or accepted equal.

E. Adjustable Shelf Standards/Supports: Knape & Vogt (K&V) **K255** with **K256** shelf clips. Shelf support for shelves less than 30" wide may use K&V **K346** for drilled holes. Other accepted equal may be submitted for acceptance prior to fabrication.

F. Exposed Adjustable Shelf Standards: Stanley natural aluminum shelf standards and brackets **No. 6733** and **6731**, **BHMA 626** finish.

G. Door and Drawer Locks: National Lock Hardware No. C817X for drawers, single doors and active leaf of pairs of doors. Provide master key and 2 keys for each lock. Cabinet locks shall be key-alike in the same room or each classroom, unless noted otherwise.

H. Screws: Straight shank double-thread particle board screws.

PART 3 - EXECUTION

3.01 Installation:

A. All cabinet work shall be performed in the same shop with experienced journeymen personnel under the supervision of a thoroughly experienced foreman. Each cabinet shall be complete and self-supporting.

B. Specified Finish Hardware shall be installed after all finish work has been completed. Inspect all drilling operations for surface splinters or de-laminations. Any piece bearing such imperfections shall be rejected.

C. Joints in the counter tops shall be secured with 1/8" x 3/4" cold rolled steel straps at 3" on center, the full length of all joints.

D. Adhesive shall be used under a cold press method using a pressure of not less than 30 psi.

E. Completed tops shall be secured to the cabinets with #10 x 1-1/4" RHWS, minimum of 4 screws per cabinet. Additional screws shall be installed at the front and back of each cabinet on both sides of the counter top joints.

F. Install all adjustable shelf standards flush by making the necessary dado cuts on the interior sides of the cabinets.

G. Hang and set cabinets in accordance with reviewed Shop Drawings.

H. Coordinate work closely with Divisions 15 and 16 for Mechanical, Plumbing, and Electrical work to be integrated into casework.

3.02 Clean-Up:

A. Upon completion of installation and as a condition of final approval, all debris, sawdust, excess materials, packages, equipment and trash which may have resulted from this work, shall be removed from site. All cabinet and millwork and adjacent surfaces shall be left clean and acceptable.

END OF SECTION

SECTION 09 65 16

Resilient Flooring – Vinyl Sheet Flooring

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
    1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
B. Related Documents
    1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

1.02 REFERENCES

A. Armstrong Flooring Technical Manuals
    1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061
    2. Armstrong Flooring Maintenance Recommendations and Procedures, manual, F-8663
B. ASTM International:
    1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
    2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
    3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
    4. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
    5. ASTM F 1861 Standard Specification for Resilient Wall Base
    6. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
    7. ASTM F 1913 Standard Specification for Vinyl Sheet Floor Covering Without Backing
    8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
C. National Fire Protection Association (NFPA):
    1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
    2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
D. Standards Council of Canada
    1. CAN/ULC-S102.2 Standard Test Method for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
B. Administrative Requirements
    1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.
C. Sequencing and Scheduling

1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.04 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061.) for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.

C. Submit Safety Data Sheets (SDS) available for adhesives, weld rod, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.

D. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.

B. Select an installer who is experienced and competent in the installation of Armstrong resilient sheet flooring [using heat-welded seams][using Armstrong Flooring S-761 Seam Adhesive method] and the use of Armstrong Flooring subfloor preparation products.

1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
2. Confirm installer's certification by requesting their credentials

C. Fire Performance Characteristics: Provide resilient vinyl sheet flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:

1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with Division 1 Product Requirements Sections

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.07 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF (18ºC) and a maximum temperature of [100ºF (38ºC)][85ºF (29ºC)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55ºF (13ºC) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to the Armstrong Flooring Guaranteed Installations Systems manual, F-5061 for a complete guide on project conditions.

1.08 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 10 years

C. The Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.09 EXTENDED SYSTEM LIMITED WARRANTY

A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.

B. Limited Warranty Period: 10 years on top of the Resilient Flooring Limited Warranty

C. [S-453 Level Strong™ cement based self-leveling compound] [S-456 Patch Strong™ flexible patching and smoothing compound] [S-454 Prime Strong™ acrylic primer for porous substrates] [S-455 Prime Strong™ acrylic primer for non-porous substrates] [S-452 Seal Strong™ two part moisture mitigation system]

D. The installation of an Armstrong Flooring product along with the recommended Armstrong Flooring adhesive, as well as any one of the Strong System subfloor preparation products listed above, provides 10 additional years of limited warranty coverage. The Strong System limited warranty covers the installation integrity for the length of the flooring product warranty plus 10 years. In order to qualify for the Strong System Warranty, any subfloor preparation product needed for an installation must be an Armstrong Flooring product.

E. For the System Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

F. When Armstrong Flooring Strong System subfloor preparation products are used with other manufacturers' floor coverings, adhesives, or other subfloor preparation products, Armstrong Flooring warrants our products to be free from manufacturing defects from the date of purchase through the limited warranty period of 15 years.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Resilient sheet flooring, wall base, adhesives and subfloor preparation products and accessories::

1. Armstrong Flooring Inc., 2500 Columbia Avenue, Lancaster, PA 17603, www.armstrongflooring.com/commercial
2. Manufacturer must have a headquarters in the United States of America

2.02 RESILIENT SHEET FLOORING MATERIALS

A. Provide Homogeneous Sheet Vinyl Flooring: ColorArt™ Medintone™ with Diamond 10® Coating manufactured by Armstrong Flooring Inc.

1. Description: An unbacked, nonlayered, homogeneous sheet vinyl flooring. Protected by a diamond-infused UV-cured polyurethane finish, the colors and pattern detail are dispersed uniformly throughout the thickness of the product. Color pigments are insoluble in water and resistant to cleaning agents and light.
2. Homogeneous sheet flooring shall conform to the requirements of ASTM F1913 Standard Specification for Vinyl Sheet Floor Covering Without Backing
3. Pattern and Color: in [%COLOR%][color selected from the range currently available from Armstrong Flooring Inc.]
4. Width: 6 ft. 7 in. (2.0 m).
5. Length: up to 65.6 lineal feet (20 meters)
6. Thickness: 0.080 in. (2.0 mm)

B. Vinyl Weld Rod:

1. Provide patterned vinyl weld rod as produced by Armstrong Flooring Inc., and intended for heat welding of seams. Color shall be compatible with field color of flooring. Color selected from the range currently available from Armstrong Flooring Inc.

C. Seam Adhesive:

1. Provide Armstrong Flooring S-761 Seam Adhesive at seams as recommended by the resilient flooring manufacturer.

2.03 PRODUCT SUBSTITUTION

A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.05 ADHESIVES

A. Provide Armstrong S-599 Vinyl Sheet Flooring Adhesive Premium Commercial adhesive for field areas as recommended by the flooring manufacturer.

2.06 ACCESSORIES

A. For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-454 Prime Strong™ acrylic primer for porous substrates. For non-porous substrates, provide S-455 Prime Strong™ acrylic primer for non-porous substrates.

B. For creating a moisture barrier, provide S-452 Seal Strong™ two part moisture mitigation system.

C. Provide transition/reducing strips tapered to meet abutting materials.

D. Provide metal edge strips of required width and thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.03 PREPARATION

A. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material. Refer to the Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F

710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

B. When using S-599 Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes, ASTM F 1869,Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride and Bond Tests as described in publication F-5061, Armstrong Flooring Guaranteed Installation Systems, manual, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Internal relative humidity of the concrete shall not exceed 90%.][MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

C. When using Armstrong Flooring S-543 Adhesive), perform subfloor moisture testing in accordance with ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes, ASTM F 1869,Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride] and Bond Tests as described in publication F-5061, Armstrong Flooring Guaranteed Installation Systems, manual, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Internal relative humidity of the concrete shall not exceed 90%. MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained].

D. For Spray Adhesive High-Moisture Installation Warranty, using Armstrong Flooring Flip™ Spray Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes” and Bond Tests as described in publication F-5061, "Armstrong Flooring Guaranteed Installation System," manual to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Internal relative humidity of the concrete shall not exceed 93%. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

E. When using S-240 Epoxy Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes”, ASTM F 1869,“Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride” and Bond Tests as described in publication F-5061, "Armstrong Flooring Guaranteed Installation System," to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Internal relative humidity of the concrete shall not exceed 90%.][MVER shall not exceed 8 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained]

F. Wood subfloors: Armstrong resilient floors are recommended on suspended wood subfloors with a 1/4" underlayment (see product installation systems for exceptions) and a minimum of 18" of well-ventilated air space below. Armstrong Flooring does not recommend installing resilient flooring on wood subfloors applied directly over concrete or on sleeper-construction subfloors. Loading requirements for subfloors are normally set by various building codes on both local and national levels. Trade associations such as APA–The Engineered Wood Association provide structural guidelines for meeting various code requirements. Subfloor panels are commonly marked with span ratings showing the maximum center-to-center spacing in inches of supports over which the panels should be placed.

1. Refer to the Armstrong Flooring Guaranteed Installation Systems manual, F-5061 for additional information.

G. Wood subfloors - Surface Cleaning: Make subfloor free from dust, dirt, grease, and all foreign materials:

1. Check panels for sources of discoloration such as contamination from paint, varnish, stain overspray or spills, plumbing sealers, asphalt, heater fuel, markers or potential staining agents such as wood or bark not visible on the surface, edge sealers, logo markings, printed nail patterns and synthetic patches.
2. Remove old adhesive.
3. Cover adhesive, oil or wax residue with an appropriate underlayment. If the residue is tacky, place a layer of felt or polyethylene sheeting over it to prevent a cracking sound when walking on the floor.
4. Remove all paint, varnish, oil and wax from all subfloors. Many buildings constructed before 1978 contain lead-based paint, which can pose a health hazard if not handled properly. State and federal regulations govern activities that disturb lead-based painted surfaces and may also require notice to building occupants. Do not remove or sand lead-based paint without consulting a qualified lead professional for guidance on lead-based paint testing and safety precautions. Armstrong Flooring does not recommend the use of solvents to remove paint, varnish, oil, wax or old adhesive residues because the solvents can remain in the subfloor and negatively affect the new installation. Whenever sanding, be certain the work site is well ventilated and avoid breathing dust. If high dust levels are anticipated, use appropriate National Institute for Occupational Safety and Health (NIOSH) designated dust respirator. All power sanding tools must be equipped with dust collectors. Avoid contact with skin or eyes. Wear gloves, eye protection and long-sleeve, loose fitting clothes
5. For additional information on the installation and preparation of wood and board-type underlayments see the current edition of ASTM F1482, “Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.”
6. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring.

3.04 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. Failure to comply may result in voiding the manufacturer’s warranty listed in Section 1.08.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.

F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.

G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

H. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

3.05 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.06 CLEANING

A. Perform initial maintenance according to the latest edition of Armstrong Flooring Maintenance Recommendations and Procedures manual, F-8663.

3.07 PROTECTION

A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061.)

END OF SECTION

SECTION 09 90 50

PAINTING OF EXISTING PAINTED SURFACES

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Section Includes

A. Supply and apply interior and exterior painting.

B. Exposed work specified in other Sections that are specified or scheduled to be finished and painted are:

1. Not finished as part of work of other Sections and not listed under Article 1.01-C, shall be finished as specified under this Section.

C. Following items shall not be painted:

1. Brass valves, chromium or nickel-plated piping and fittings.

2. Boiler control panels and control systems.

3. Fabric connections to fans.

4. Flexible conduit connections to equipment, miscellaneous name plates, stamping and instruction labels and manufacturer's data.

5. Mechanical and electrical utility lines, piping and heating and ventilation ductwork in tunnels, underfloor excavated areas or crawl spaces, attic spaces and enclosed utility spaces.

6. Products and equipment having a complete factory finish.

7. Flag, floodlight, parking light poles and loudspeaker poles furnished with a galvanized finish.

8. Structural and miscellaneous, steel, open web steel joists and metal floor decking which will not be exposed in final construction, shall have no finish other than one coat of shop primer.

9. Hardboard covering on tops and backs of counters and benches.

10. Items specified with galvanized finish.

11. Brass, bronze, aluminum, lead, stainless steel, and chrome or nickel-plated surfaces.

1.02 Submittals

A. Submit in accordance with Section 01 33 00: Submittal.

1. Submit a complete list of all materials to be furnished stating supplier and distributor's names.

2. Submit manufacturer's standard color samples for each type of paint specified. Once colors have been selected, submit 3 samples of each color selected for each type of paint, on standard 8-1/2" x 11" spray-out panel.
3. Submit certification of materials under Article 1.03: Quality Assurance.

1.03 Quality Assurance

A. Certification of Materials: With every delivery of paint material, manufacturer shall certify, on form supplied by the District, that materials comply with requirements of this Section.

B. Paint materials shall comply with applicable requirements of the Federal Food and Drug Administration's (FDA) Lead Law, California's volatile organic compound (VOC) compliance requirements, and all applicable requirement by the South Coast Air Quality Management District (SCAQMD.)

1.04 Delivery, Storage and Handling

A. Materials shall be delivered to project site in original unbroken containers bearing manufacturer's name, brand number and batch number.

B. Open and mix ingredients on premises in presence of the District Inspector. Immediately remove rejected materials from premises.

C. Storage and Mixing of Materials: Store materials and mix only in spaces designated for purpose by the District Inspector. Keep such spaces clean and take necessary precautions to prevent fire. Hang out oily rags flat and singly in the open air. Stack paint containers so that manufacturer's labels are clearly displayed.

1.05 Environmental Conditions

A. Temperature: Do not apply exterior paint in damp, rainy weather or until surface has thoroughly dried from effects of such weather. Do not apply paint, interior or exterior, when temperature is below 50 F., or dust conditions are unfavorable to proper workmanship.

1.06 Warranty

A. Materials and workmanship warranty shall be in accordance with requirements of the Contract Documents, except that warranty shall be furnished jointly by Contractor and materials manufacturer.

PART 2 - PRODUCTS

2.01 Paint Materials

A. All materials used on the work are to be exactly as hereinafter specified in kind and quality. No claim

by the contractor as to the unsuitability or unavailability of any material specified or his unwillingness to use same, will be entertained unless such claims are made in writing and submitted with the bid.

1. All materials used in the work except oils, thinners and driers, shall be of the brands and qualities specified and shall be delivered to the job in their original containers with labels intact and seals unbroken.

2. No other paints shall be brought on the job. Oils, thinners and driers delivered to the job shall be only those approved for use by the manufacturer of the paints.

3. No paint shall be reduced, or faster drying induced by the addition of any product designed for such purpose except as recommended by the paint manufacturer.

4. Thinners or solvents used for cleaning brushes or other clean-up, shall not be used in the paint.

5. Paints which have been packaged over six months shall not be used in the work, except such products as are known to have long package stability when unopened, and then only when guaranteed by the manufacturer and approved by the Architect.

PART 3 - EXECUTION

3.01 Preparation of Existing Painted Surfaces

A. Examine surfaces to receive paint finish. Surfaces which are not properly prepared and cleaned or which are not in condition to receive the finish specified, shall be corrected before paint is applied. No painting shall be done on existing painted surfaces until surfaces are approved by the District Inspector.

B. Existing painted surfaces indicated to be painted, shall be prepared as follows:

1. Wood and plaster surfaces shall be washed with a strong solution of an approved cleaner, to remove dirt, grease and other foreign materials and rinsed with clean water. Surfaces shall have wax completely removed before washing.

3.02 Preparation of Plaster Surfaces

A. The following procedures are to repair plaster and stucco cracks prior to painting:

1. Hairline Cracks: Two coats of elastomeric coating will bridge hairline cracks.

2. Small to Medium Cracks: The elastomeric coating will fill and span cracks up to 1/32". A credit card width or greater needs to be treated with elastomeric sealant (recommended by the Paint Manufacturer) prior to applying the elastomeric coating.

3. Medium to Large Cracks: Cracks from 1/32" to 1/8" require treatment with a brush-grade elastomeric sealant, applied in a 2" wide band; crowned at the center and feathered at the edges to conceal repair.

4. Large Cracks: Cracks 1/4" to □" require a urethane sealant (recommended by the paint manufacturer), "rake out" the crack(s) to a 1/4" minimum to allow the repair(s) to conform to the manufacturers specifications. Apply as directed for medium to large cracks.

5. Cracks, holes, and damaged spots larger than □", See Section 09200: Lath and Plaster.

3.03 Preparation of Exterior Wood Surfaces

A. Surface Preparation:

1. new wood should be painted promptly within a few weeks. Moisture in treated wood left from the treatment process should be allowed to dry prior to painting; once constructed, provide at least two weeks exposure to the weather for drying of siding materials; thicker timber may take longer

2. Dull any shiny (mill glazed) areas with fine grit (#220) sandpaper.

3. Treat any mildew with a 3:1 water and household bleach mixture, leaving it on for 20 minutes and adding more as it dries; refresh the surface of any weathered wood by sanding with medium grit (#120) garnet paper, sanding in the direction of the grain.

B. Priming:

1. Apply a quality exterior latex or oil-based stain blocking primer.

2. Apply 2nd coat if primer exhibits stain bleed through.

3. Do not leave a primer unpainted.

3.04 Cleaning

A. Remove rubbish, waste and surplus material from floors and other adjacent work.

B. Remove paint, varnish and brush marks from glazing material and, upon completion of painting work, wash and polish glazing material both sides. Glazing material which is damaged shall be removed and replaced with new material at no cost to the District.

C. Clean hardware and other unpainted metal surfaces with approved cleaner. Do not use abrasives or edged tools.

3.05 Schedule

A. Interior:

1. Plaster: 2 coats.
Prime Coat: At all cracks that have been repaired.
First and Second: Interior enamel, semi-gloss or gloss as indicated.

2. Existing Concrete: 2 coats.
   Concrete Sealer: At repaired surfaces.
   First and Second: Interior enamel, semi-gloss or gloss as indicated.

3. Concrete Block: 2 coats.
   Concrete Block Filler: At repaired surfaces.
   First and Second: Interior enamel, semi-gloss or gloss as indicated.

B. Exterior:

1. Existing Plaster and Stucco: 2 coats.
   Exterior 100% acrylic.

2. Existing Concrete: 2 coats.
   First and Second: Exterior 100% acrylic.

3. Existing Concrete Block: 2 coats.
   Concrete Block Filler: At repaired surfaces.
   First and Second: Exterior 100% acrylic.

4. Existing Wood surfaces: 2 coats.
   Wood primer: latex or oil-based stain blocking primer at repaired surfaces.
   First and Second: Exterior 100% acrylic. (quality oil-based or alkyd paint may be used with oil-based primer)

END OF SECTION

SECTION 10 14 00

SIGNAGE

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Section Includes:

A. Acrylic signs.

B. Letters and numbers.

1.02 References:

A. CCR - California Code of Regulations, Title 24, Part 2.

B. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.03 Submittals:

A. Submit shop drawings under provisions of Section 01 33 00.

B. Submit shop drawings listing sign styles, lettering and locations, spacing and installation method.

C. Submit samples under provision of Section 01 33 00.

D. Submit two samples illustrating full size sample sign, of type, style and color specified including method of attachment.

E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

F. Include installation templates and hardware.

1.04 Regulatory Requirements:

A. Conform to CCR, Title 24, Part 2 and ADAAG for access for the handicapped.

B. Character type: Characters on sign shall be raised 1/32-inch (0.794 mm) minimum and shall be sans serif uppercase characters accompanied by Grade 2 Braille.

C. Character size: Raised characters shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high.

D. Finish and contrast: Contrast between character, symbols and their background must by 70% minimum

and have a non-glare finish. 11B-703.5.1. Colors and font to match existing at Building G.

E. Proportions: Characters shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter”I”. CBC 11B-703.5.4.

F. Braille: California Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Dots shall be 0.10 inch on centers in each cell with 0.30-inch space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised in minimum of 1/40 inch (0.635 mm) above the background. 11B-703.3.

G. Required Rounded or domed California Braille dots, each distinct and separate. Dots with straight sides and flat tops are not readable for many Braille users.

1.05 Environmental Requirements:

A. Do not install adhesive mounted signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

PART 2 - PRODUCTS

2.01 Materials:

A. Room identification signage: Braille Signs, Inc., 1-949-797-1570 of Irvine, Ca., or accepted equal, with integral California Contracted Grade 2 braille copy. Material shall be 1/8-inch-thick x 6-inch-high ES plastic plate of length required with ¾ inch high Aoptima @ lettering; Letters shall be inlaid and not removable by vandals, 1” high room number; mechanically mounted, with tamper proof toggle bolts, with copy centered on plate. Provide one sign for each door. Signage to be in compliance with the requirements of Article 4.30 and A4.30 of the ADAAG and Title 24, Part 2, Section 11B-701.

B. Restroom door signage: Acrylic plastic signs equivalent to that as detailed on the drawings; 12-inch circle and triangle with international symbol of accessibility in accordance with CCR, Title 24, Part 2, Section 11B-703.7.2.6.

C. Fire extinguisher signs: similar design style to room name and number signs except with white letters on bright red background. Vertical and horizontal mounting. Size and color of sign shall meet all requirement of local Fire Department. Vomar products or equal.

1. Substitutions: Under Provisions of Section 01 25 00

D. Traffic Signage:

1. Van Parking Stall: 12 inch x 18 inch porcelain handicapped sign in accordance with CCR, Title 24, Part 2, Section 11B-502.6 and separate 12 inch wide x 4 inch high porcelain sign with “Van-Accessible” wording in accordance with ADAAG Article 4.6.4 with 2 inch diameter standard weight galvanized steel pipe post; as manufactured by Flags and Banners Unlimited or accepted equal.

2. Auto Parking Stall: 12-inch x 18-inch porcelain access sign in accordance with CCR, Title 24, Part 2, Section 11B-502.6, with 2-inch diameter standard weight galvanized steel pipe post; as manufactured by Flags and Banners Unlimited or accepted equal.

3. Drive Approach: 18-inch x 24-inch porcelain tow-away sign with local address and police phone number in accordance with CCR, Title 24, Part 2, Section 11B-502.8 with 2-inch diameter standard weight galvanized steel pipe post; as manufactured by Flags and Banners Unlimited or accepted equal.

4. Accessories: Provide all anchors and accessories for a complete installation.

PART 3 - EXECUTION

3.01 Examination:

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 Installation:

A. Install in accordance with manufacturer's instructions. Do not install signs with adhesive.

B. Install true, plumb, level and adequately secured to substrate.

C. Clean and polish.

END OF SECTION

SECTION 12 36 61

SIMULATED STONE COUNTERTOPS

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.

1.02 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.01 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Slightly eased at top

2. Backsplash: Straight, slightly eased at cove and top.

3. Endsplash: Matching backsplash

B. Countertops: 3/4-inch thick, solid surface material with front edge built up with same material.

C. Backsplashes: 3/4-inch thick, solid surface material.

2.02 COUNTERTOP MATERIALS

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following unless noted otherwise.

   (a) Avonite Surfaces.
   (b) E. I. du Pont de Nemours and Company.
   (c) Formica Corporation.
   (d) LG Chemical, Ltd.
   (e) Meganite Inc.
   (f) Samsung Chemical USA, Inc.
   (g) Swan Corporation (The).
   (h) Transolid, Inc.
   (i) Wilsonart International.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION

SECTION 13 60 50

MOVING AND RELOCATING MODULAR
RELOCATABLE CLASSROOM UNITS

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Move and relocate all Modular Relocatable Classroom Units as indicated, but not limited to, the following:

1. Site preparation.

2. Demolition, including removal of paving, etc.

3. Grading, excavation and filling.

4. Footings, walls, etc.

5. Disassemble, disconnect and move classroom units, including platforms, skirting, closures, etc., and set, reassemble and connect in their new locations.

(a) Remove, salvage and reinstall electric panels, etc., and provide new electric work, as required.

(b) Paint as required.

(c) Remove foundations and cleanup site from which classroom units are removed.

(d) Clean-up.

1.02 Quality Assurance

A. Requirements of Regulatory Agencies:

1. This specification is based on quality, materials, methods, and workmanship as contained in California Code of Administration 24, and the 2022 Edition of the California Building Code.
2. This Contractor shall observe all rules, regulations, ordinances, etc., of all City, County, and State Agencies as they pertain to routes of travel, closure of streets, removal and replacement of utility lines, hours of travel, etc.

3. Any disassembling, removal of overhangs and canopies, etc., required to obtain approval of and/or permits from Agencies mentioned above shall be performed as required and the Contractor will be allowed no additional compensation therefor. All reassembling, replacing, etc., shall be performed as required.

B. Permits: The Contractor shall obtain and pay for all permits required from all City, County, and State

Agencies having jurisdiction over this type of work.

1.03 Examination of the Site & Contract Documents:

A. Before submitting a bid, bidders shall carefully examine the drawings, read the specifications, shall visit the site(s) of the work, and shall fully inform themselves as to all existing conditions and limitations, and shall include in the bid a sum to cover the cost of all items included in the contract documents.

1.04 Special Provisions:

A. Layout of Work:

1. Contractor shall notify the Architect at least two (2) days prior to layout of the work if additional data will be required.

2. Location and elevations of all structures to be constructed under this contract are shown on the drawings and unless any discrepancies therein are brought in writing, to the attention of the Architect prior to beginning of construction, Contractor will be held responsible for the proper locations and elevations as shown and as intended.

B. Any and all fences, and/or playground equipment, etc., on school sites which are in the routes of travel designated for the units and will interfere with the moving operations shall be removed and replaced by the Contractor. Any trees on school sites which are in the designated routes of travel or which interfere with the moving or locating of the units shall be removed by the Contractor. Any trees, mailboxes, utility lines, etc., in streets, etc., which interfere with the moving of the units shall be protected, replaced, etc., as the case may require, by the Contractor.

C. All items of furniture, casework, etc., which are not attached to the building units will be removed from the units by the District and stored by the District.

D. All items of casework, cabinets, fixtures, etc., which are attached to the building units shall be removed, where necessary, by the Contractor and stored by the Contractor. After the units have been relocated, set and connected, the items mentioned above shall be installed in the units in their new locations, secured in place, connected to their required utilities, etc., complete and ready for use. Except as hereinafter designated any losses or damage resulting from the moving, etc., shall be replaced or repaired in kind to the satisfaction of the District. Any cabinets, casework, etc., not required to be reinstalled shall be delivered to the District.

E. The Contractor shall coordinate the work of the several trades to keep the interruption of services, particularly water, gas, electric, sewer, etc., to a minimum. Where possible, changes in utility service shall be made when school or office areas are not in use (before or after school or office hours or on weekend days). Should it be necessary to interrupt services which school or office areas are in use, the contractor is required to give the Owner's Director of Maintenance 24 hours written notice and it is required that such interruption be limited to 30 minutes maximum time per day for each utility service interrupted. If additional time is required, arrangements must be mutually agreed upon in advance.

1.05 Protection and Restoration

A. This Contractor shall preserve and protect from injury all trees, poles, fences, playground equipment, walls, paving, structures, etc., and shall store or replace, without cost to the Owner, any and all trees, poles, fences, playground equipment, shrubs, grass, walls, paving, structures, etc., that may be

removed or damaged in the performance of this work, using the same materials and specifications as for the originals work, and to the complete satisfaction of the District.

B. Restore, without cost to the Owner, off-site pavement, curbs, walks, fences, mailboxes, utility lines etc., that may be broken or damaged in any manner in the performance of this work.

C. It shall be the responsibility of this Contractor to protect from damage and/or injury any and all portions of the units being moved and shall restore and/or replace any and all damage to the building units as a result of this work.

D. All utility lines disconnected at sites from which units are being moved shall be capped, plugged, or otherwise rendered inactive in an acceptable manner.

E. Patching shall be of the same materials, workmanship, and finish as, and shall accurately match, all existing surrounding construction.

PART 2 - PRODUCTS

2.01 Equipment:

A. Owner Furnished Equipment: The Owner will furnish to the Contractor, for the use in this work, no templates, no moving rig assemblies, etc.

B. Contractor Furnished Equipment: The Contractor shall furnish all equipment, such as jacks, timbers, cribbing, bracing, dollies, power, vehicles, templates, etc., required in the performance of this work.

2.02 Miscellaneous Steel:

A. Provide and install all items of miscellaneous steel, such as anchor bolts, steel channels, clips, etc. shown and required.

2.03 Metal Fabrication:

A. Handrails shall be fabricated as required. Welds shall be ground smooth. Galvanize after fabrication.

2.04 Skirting:

A. Provide and install skirting at entire perimeter of units, between bottom of wall panels on floor framing and foundations or grade to completely enclose the area between floor line and grade. Skirting and finish grade at perimeter of units shall be such that surface water will not flow under classroom units. Skirting shall be same materials and color as siding.

2.05 Concrete Work:

A. Furnish and place all concrete, including reinforcing steel, etc., as specified and shown on the drawings.

1. Concrete mixes shall comply with the arbitrary mix shown in Table T21-26-A, Title 21.

2. Concrete Curing: Sita-Antisol or Horntraz curing material shall contain a fugitive dye.

Application shall be in strict compliance with manufacturer's specifications.

3. Form Materials: Plywood-Douglas Fir APA Exterior BB Grade or better.

4. Reinforcing Steel: Wire mesh, ASTM-185, minimum 6 X 6, 10/10 EWWM.

5. When a straightedge 10 feet long is laid on the surface of the sidewalk, the surface shall not vary more than 1/16 inch form the edge of the straightedge, except at grade changes or curves.

2.06 Storm Drainage:

A. Furnish and install storm drainage piping as required, including all necessary trenching, excavation, shoring, and backfilling required for the proper laying of the pipe.

1. Use only new materials, and unless prefabricated, deliver to the site in standard sizes. Use the standard product of one manufacturer for each article of its type.

2. All concrete used for drainage structures shall have a minimum 28-day strength of 2500 psi and shall be mixed, placed, and finished as specified in the Concrete Work Section of these specifications. The aggregate shall have a maximum size of 1-1/2 inches.

2.07 Sealants:

A. Sealants shall be PRC Rubber Caulk Series 2000 and 7000. Similar products by Dow Corning and Tremco will be acceptable.

B. Application shall be in accordance with manufacturer's requirements.

2.08 Painting:

A. All galvanized metal surfaces shall be treated with Galvaprep.

B. Paints shall be by Dunn Edwards.

C. All materials used in the work except oils, thinner and driers shall be delivered to the job in their original containers with labels intact and seals unbroken.

PART 3 - EXECUTION

3.01 Asphaltic Concrete Paving:

A. Install all paving as shown on the drawings to comply with the requirements of the specifications of the Asphalt Institute.

3.02 Painting:

A. All interior painted surfaces which are scratched, damaged, etc., in the performance of this work, shall be touched up and repainted using the same materials as originally used and accurately matching all existing surrounding areas.

B. Unless indicated otherwise all exterior painted surfaces shall be touched-up and shall be given one coat

of paint, using the same methods, materials, etc., as used when units were constructed.

3.03 Closure Strips:

A. Remove closure strips between units as required for moving. Provide closure strips of same materials as existing at roof, walls, overhangs, etc., between al units in their new locations.

3.04 Hardware:

A. All hardware on doors, etc., shall be in satisfactory operating condition in units after they are moved and relocated.

B. Any changing of cylinders in door locksets required to obtain the desired keying will be done by the District.

3.05 Electrical Work:

A. All electrical work, such as disconnecting services and feeds at existing locations, new service runs and feeds at new locations, connecting up, placing in an operating condition 110 volt, single phase power and lighting, fire alarm system, signal system, 220 volt single phase power, etc., shall be performed and completed in accordance with the drawings and as required to cause all electrical equipment, heaters, lighting fixtures, etc., to be in operating condition and ready for use in all units in their new locations. Disconnect, move, relocate and connect up all existing main switchboards, panels, etc., indicated to be salvaged and reinstalled.

B. Electrical contractor shall de-energize feeders for portable, cut conduits to 6 inches below grade, remove conductors and identify c/b's at main switchboard as spaces.

3.06 Plumbing:

A. All plumbing work, such as disconnecting from existing utility lines at existing location of units, extensions of new utility lines and connections to all plumbing fixtures, etc., shall be performed as shown on the drawings.

3.07 3Moving and Relocating Units:

A. The units indicated to be moved shall have the metal closure strips removed, skirting, etc., removed as required to make anchor bolts accessible, carpet removed from floor areas if required, etc. Remove nuts from anchor bolts, etc. Properly disconnect all utilities. Units shall be raised, placed on moving equipment and then transported to their new locations.

B. After the footings, slabs, utilities, etc. have been prepared ready to receive the units, they shall be carefully and accurately positioned and placed upon the footings, secured in place, metal closure strips replaced, utilities shall be connected, painting shall be done, etc. as required and specified.

3.08 General Tough-Up, Repairs, Etc.:

A. Any, or all portions of units, which may be broken, damaged, marred, rendered unsightly, etc., although not specifically mentioned above, shall be repaired, replaced, etc. to the complete satisfaction of the District, as a part of the work required under these specifications. It is intended that the units in their new locations shall be complete and ready for use.

B. Routes over which the units will travel on school sites will be determined by the District and points of exit from and egress to school sites will be determined by the District.

3.09 Conditions at Completion:

A. Upon completion of this portion of the work, all equipment, surplus materials, debris, etc. resulting from this work, shall be removed from the premises, including sites to which units are moved and sites from which units are removed.

B. At sites from which units are removed all existing foundations, piers, etc. from which units are removed, shall be removed from the premises; any resulting cavities shall be filled with suitable fill materials and the entire area left in a neat, clean, smooth and acceptable condition. Remove all underground or buried electrical conduit, piping, etc.

END OF SECTION

SECTION 22 05 13

BASIC PLUMBING MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing.

3. Division 26: Electrical.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.03 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

C. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the ARCHITECT.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards, manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.02 MANUFACTURERS AND MATERIALS

A. Ball Valves: 2-inch and smaller:

BV-1: Class 150, 600 psi, Bronze, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: NIBCO T-685-66-LF/S-685-66-LF, Hammond UP8303A/UP8513, Milwaukee UPBA400S/ UPBA450S, or equal.

BV-2: Class 150, 600 psi, Stainless Steel, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: NIBCO T-585-S6-R-66-LL, Milwaukee BA260, or equal.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-Seal Handle.

B. Butterfly Valves:

BFV-1 Centerline Series A, 200 psi CWP tight shut-off.

1. Body: Lug type ductile iron. Suitable for bi-directional dead-end service at rated pressure without use of downstream flange.

2. Disc: Bronze, or aluminum bronze.

3. Stem: One or two-piece, 400 series stainless steel.

4. Seat and O-Rings: EPDM.

5. Upper and Lower Stem Bearings: Copper alloy or non-metallic material.

6. Operators: Valves 6 inches and smaller, with lever handle. Valves 8 inches and larger, with manual gear operator and disc position indicator.

7. Manufacturers:

a) Valves 2.5 to 6-inch: Milwaukee ML 233E, Hammond 6411-03, or equal.

b) Valves 8-inch and larger: Milwaukee ML 333E, Hammond 6411-03, NIBCO LD 2000, or equal.

C. Check Valves:

a) Valves 2.5 to 6-inch: Milwaukee ML 233E, Hammond 6411-03, or equal.

b) Valves 8-inch and larger: Milwaukee ML 333E, Hammond 6411-03, NIBCO LD 2000, or equal.

C. Check Valves:

1. Bronze, 2-inch and smaller:

CHV-1: 200 psi, CWP horizontal swing, Y pattern, renewable seat and disc, threaded ends.

Manufacturer: NIBCO T-413-Y-LF, Milwaukee UP-509, Hammond UP-904, or equal.

CHV-2: 200 psi, CWP, bronze body, horizontal swing, Y pattern, renewable seat and disc, solder ends.

Manufacturer: Nibco S-413-Y-LF, Hammond Up-943, or equal.

CHV-3: Class 125, 200 psi, swing check, bronze body, Teflon disc, soldered ends.

Manufacturer: Stockham B-310TY, Crane 1340, NIBCO S-413-Y, Milwaukee 1509-T, Hammond IB-912, or equal.

2. Cast Iron 2 1/2-inch and larger:

CHV-4: Class 125, 200 psi, CWP, IBBM, renewable seat and disc, bolted cap, threaded ends:

Manufacturer: Crane 372, Stockham G-927, NIBCO T-918-B, or equal.

CHV-5: Special low-pressure check valve for installation in gas lines.

Manufacturer: Circle Seal Products Co., 119B-xPP; 0-15 psi; #1:1/8 inch IPS; #2:1/4 inch IPS #3:3/8 inch IPS.

D. Earthquake Valve:

EQV-1: Mechanically triggered by seismic movement, complying with state of California seismic response specifications, UL listed and certified by D.S.A. Size and pressure as required or indicated on Drawings. (Minimum 1/4 psi, maximum 10 psi. Earthquake valve shall shut off gas automatically during an earthquake to prevent an explosion or fire. Valve shall be Koso California seismic valve, or equal.

1. Not sensitive to vibrations caused by passing trucks or accidental bumping.

2. Sensitive to wide amplitude G's only. Preset at factory for the correct G-rating.

3. Positive sealing from minus 10 degrees F. to 150 degrees F.

4. Visual open-close indicator.

5. Manual reset.

6. Plumb line for mounting.

7. Tripping mechanism has non-creeping rolling latch.

8. Install valve per manufacturer's recommendations only.

E. Expansion Tank:

ET-1: Pressurized, vertical, steel expansion tank for potable water systems with FDA approved, replaceable, heavy duty, butyl rubber blend diaphragm, polypropylene lined dome, 1/2 inch, 3/4 inch, 1 inch or 1 ½-inch NPT system connection, 1/2 inch or 3/4 inch drain, 0.302 inch-32 standard automobile tire valve type charging connection, lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VII of the ASME Boiler and Pressure Vessel Code and stamped for 125 psi working pressure. The tank must be also rated for a continuous working temperature of 240 degrees F. Provide weather and rust resistant coating.

Manufacturer: Bell and Gossett, Wheatley, Taco, Amtrol, or equal.

F. Flow Control Valve – Manual:

FC-1: Flow control valves: Bell and Gossett Series CB circuit setter balancing valve, line size, with integral pointer (to register degree of valve opening), differential pressure meter connections with built-in check valves and lockable memory stops. Manufacturer: Armstrong ARMFLO circuit-balancing valves, series CBV, or equal.

G. Gate Valves:

1. Bronze, 2-inch and smaller:

GV-1: Class 125, 200 psi, CWP, bronze body and bonnet, non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

Manufacturer: NIBCO T-113-LF, Milwaukee UP105-P2, Hammond UP645, or equal.

GV-2: Same as GV-1, except solder ends:

Manufacturer: NIBCO S-113-LF, Milwaukee UP115, Hammond UP647, or equal.

2. Bronze, 2-1/2-inch and larger:

GV-3: Class 125 250 psi CWP iron body, flanged ends, bolted bonnet with wheel handle, resilient wedge, non-rising stem.

Manufacturer: NIBCO F-619-RW, or equal.

GV-4: Class 125, 250 psi CWP iron body, flanged ends, bolted bonnet with 2-inch operating nut, resilient wedge, non-rising stem, fusion bonded epoxy coated.

Manufacturer: NIBCO F-619-RW-SON, or equal.

GV-5: Class 250, 250 psi, CWP, O S and Y, IBBM, resilient seat gate valve, flanged ends.

Manufacturer: Watts 408-OSYRW, or equal.

GV-6: Class 125, 200 psi CWP, bronze body and bonnet non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends.

Manufacturer: Hammond IB645, Crane 1701, Milwaukee 105, American 3F, NIBCO T-113, or equal.

H. Globe Valves:

1. Bronze, 2-inch and smaller:

GLV-1: Class 125, 200 psi, CWP, screw-in bonnet, Teflon disc, threaded ends:

Manufacturer: Milwaukee UP502-P2, Hammond UP440-P2, or equal.

GLV-2: Class 125, 200 psi, CWP, screw in bonnet, Teflon disc, soldered ends.

Manufacturer: Hammond UP418, Milwaukee UP1502, or equal.

I. Heater Vent Pipe:

1. Schedule Number:

HVP-1 Shall be UL approved for service specified. Concealed heater vent pipe, including pipe in or through attic spaces, shall be Los Angeles City approved double wall metal vent pipe. For recessed wall heaters, furnish B.W. type. All others may be Type B, or B.W. Clearances must comply with Los Angeles City code and conditions of UL listing.

Manufacturer: American Metal Products Co., Inc., Simpson Dura-Vent, AmeriVent, Hart & Cooley Mfg. Co., Metalbestos, or equal.

J. Liquid Level Gage:

LLG-1 Refrigerant type, carbon steel with stainless steel trim or all forged steel construction, back-seating standard design. Upper and lower valve furnished with ball check valves; 1/2 inch diameter glass on center. Four 3/16 inch diameter gage glass guard rods or slotted steel guard.

Manufacturer: Peneberthy, Henry, Conbraco, or equal.

K. Piping and fittings:

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 0553: Plumbing Identification.

P-1: Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1a: Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1b: Cast iron, soil or waste, Heavy-duty no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 4 bands for size 5-inch thru 10-inch. IAPMO, ASTM C564 and CISPI 310.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1c: Same as PF-1a with Heavy Duty Husky SD 4000 Coupling and stainless steel clamps. IAPMO, ASTM C564 and CISPI 310.

P-2: Galvanized steel, Schedule 40, ASTM A53.

Manufacturer: US Steel or equal.

PF-2: Malleable iron, Class 150, threaded, galvanized, beaded, ANSI B 16.3.

Manufacturer: Stockham, Stanley Flagg, Grinnell, or equal.

P-3: Copper drainage tube, inside structure and above grade. Type DWV hard temper, ASTM B 306.

Manufacturer: Mueller, Anaconda, Cerro Brass, Cambridge-Lee, Halstead, or equal.

PF-3: Cast brass drainage fittings ASA B 16.23, ASTM B 42.

Manufacturer: Mueller Brass, Nibco, Stanley Flagg, Lee Brass, or equal.

P-4: Copper water tube, Type L hard, ASTM B88. (For above ground use only.)

Manufacturer: Mueller, Cambridge-Lee, Halstead, or equal.

PF-4a: Copper Press-Connect pressure fittings, comply with ASME B16.51 “Copper Alloy Press-Connect Pressure Fittings”, with Ethylene Propylene Diene Monomer, EPDM O-Ring Seal in each end. Fittings with the sizes of 2-1/2” and larger shall have cross-section Grab Rings and separation rings.

Manufacturer: Viega, Mueller Industries, Apollo, or equal.

PF-4b: Wrought copper - solder type ANSI B 16.22.

Manufacturer: Mueller Brass, Nibco, Lee Brass, or equal.

PF-4c: Grooved end type– ASTM B75 or B152 and ANSI B16.22 wrought copper, bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSIbB16.18. Couplings shall be CTS style 606 supplied with angle pattern bolt pads for rigidity, coated with copper coated alkyd enamel. Gaskets shall be pre-lubricated Flush seal type.

Manufacturer: Victaulic, or equal.

P-5: Copper water tube, Type K hard, ASTM B88.

Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

P-6: Type 316L Stainless steel chemical waste pipe, marked with manufacturer's identification and fittings. Manufacturer's representative shall instruct installers and certify them for

joint installation. Piping system shall be provided with a five-year manufacturer's material warranty.

Manufacturer: Blucher-Josam, Viega, or equal.

PF-6a: Type 316L Stainless Steel Mechanical joints. Stainless steel joint for chemical waste piping systems including drain or bottle traps.

Manufacturer: Blucher-Josam, or equal.

PF-6b: Type 316L Stainless Steel Press Fittings. For chemical waste piping systems including drain, vent or bottle traps, provide with EPDM seals. For compressed air piping systems, provide with HNBR seals. Manufacturer's representative shall instruct installers and certify them for joint installation.

Manufacturer: Viega, or equal.

P-7: Black steel pipe, Schedule 40, ASTM A53, Type E, ERW.

Manufacturer: US Steel, or equal.

PF-7a: Malleable iron, Class 125, ANSI B 16.3, threaded or welded Schedule 40 black steel for 2-inches and below and welded for 2 ½-inch and above.

Manufacturer: Stockham, or equal.

PF-7b: Grooved end type– ASTM A395 and A536 ductile iron; ASTM A234 WPB forged steel; fabricated from ASTM A53 carbon steel. Couplings shall be supplied with angle-pattern bolt pads for rigidity, except in locations where flexibility is desired. Gaskets shall be pre- lubricated.

Manufacturer: Victaulic, Galvanized or painted, or equal.

PF-7c: MegaPressG, ASME B31, Carbon Steel, – For aboveground piping 2-inches and below. Provide fittings with Hydrogenated Nitrile Butadiene Rubber, HNBR Sealing Element.

Manufacturer: Viega, or equal.

PF-7d: Malleable Iron, class 125, ANSI B 16.3, threaded schedule 80 black steel.

Manufacturer: Stockham, or equal.

P-8: Red seamless brass 85-5-5-5, iron pipe size (IPS), threaded pipe, ASTM B43.

Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

PF-8: Bronze and brass, 250 psi, threaded, ASA B16.17 and F S WW-P-460.

Manufacturer: Mueller Brass, Lee Brass, or equal.

P-9: PVC, thick wall, cast-iron OD sized, UL, and NSF listed, comply with AWWA C900, and ASTM D1784 Cell Class 12454B, with tracer wire.

Manufacturer: Blue Brute, or equal.

PF-9: Ductile Iron conforming to AWWA C110, and AWWA C153, with bell and spigot gasket joints conforming to AWWA C111/A21.11.

Manufacturer: EBAA Iron Sales Inc. Megalug 2000PV, or equal.

P-10: CPVC (Chlorinated polyvinyl Chloride) schedule 40 pipe, conforming to ASTM D1784, and UL723 (ASTM E84).

Manufacturer: Spears, Corzan, Charlotte, or equal.

PF-10: CPVC (Chlorinated Polyvinyl Chloride) schedule 40 fittings, conforming to ASTM D1784, and UL723 (ASTM E84). The joints shall be of solvent cement type conforming to ASTM F493. Installer shall be certified by the manufacturer for this type of joint installation. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints.

Manufacturer: Spears, Corzan, Charlotte, or equal.

P-11: PVDF (Polyvinylidene Fluoride) schedule 40 chemical waste pipe, conforming to ASTM F1673, ASTM D3222 and complying with UL723 (ASTM E84). The joints shall be no-hub mechanical Joints or Socket Fusion. Installer shall be certified by manufacturer for joint installation.
Manufacturer: Orion, or equal.

PF-11a: PVDF (Polyvinylidene Fluoride), schedule 40, No-hub coupling. Each coupling shall have 300 series stainless steel outer band and 5/16 inch bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this type of joint installation.

Manufacturer: Orion, or equal.

PF-11b: PVDF (Polyvinylidene Fluoride), schedule 40 coupling. Joined using the socket fusion system conforming to ASTM 2657. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this kind of joint installation.

Manufacturer: Orion, or equal.

P-12: FRPP (Flame Retardant Polypropylene) schedule 40 chemical waste pipe, conforming to ASTM F1412 and ASTM D4101. The joints shall be no-hub mechanical joints or Socket Fusion type. Installer shall be certified by the manufacturer for joint installation.

Manufacturer: Orion, or equal.

PF-12a: FRPP (Flame Retardant Polypropylene), schedule 40, No-hub coupling. Each coupling shall have 300 series stainless steel outer band and 5/16 inch bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this type of joint installation.

Manufacturer: Orion, or equal.

PF-12b: FRPP (Flame Retardant Polypropylene), schedule 40 coupling. Joined using the socket fusion system conforming to ASTM 2657. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this kind of joint installation.

Manufacturer: Orion, or equal.

P-13: Polyethylene plastic pipe, ASTM D 2513, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi and 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, orange or yellow color. Installer shall be certified by the manufacturer for this kind of joint installation.

Manufacturer: CPCHEM (Chevron Phillips Chemical Company LP) PE 2406, or equal.

PF-13a: Polyethylene plastic fittings, ASTM D 3261 and D 2683, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi at 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, Installer shall be certified by manufacturer for joint installation. Color orange or yellow.

Manufacturer: CPCHEM, (Chevron Phillips Chemical Company LP), or equal.

PF-13b: Polyethylene transition risers, for PF-13a above, Transition fitting must have a minimum vertical height of 36 inches from the horizontal connection which will allow for a 6-inch steel riser above ground. Polyethylene transition risers shall be anodeless.

Manufacturer: Central Plastics Company, or equal.

P-14: PVC, schedule 40, extruded from 100 percent virgin Polyvinyl Chloride (PVC) compound, meeting requirements of class 1254-13 of ASTM D1784. (Use for irrigation systems after the control valves only.)

Manufacturer: Spears, Charlotte, or equal.

PF-14 Plastic fittings, schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466.

Manufacturer: Spears, Charlotte, Harvel Plastics Inc., or equal.

P-15: Purple pipe, PVC, schedule 40 for reclaimed or recycled water (below ground only for non-potable irrigation systems), type 1, grade 1, PVC-1120, Cell Class 12454 B.

Manufacturer: Charlotte, or equal.

PF-15: Purple Plastic fittings, schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466. Refer to section 32 8426 “Reclaimed Water Irrigation”.

Manufacturer: Charlotte, or equal.

L. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I

PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Compressed air	All sizes	P-6	PF-6
Condensate drains and drains From HVAC Equipment	All sizes	P-4, or P-6 *Roof penetration & above, and exterior exposed piping shall be P-6 only	PF-4b, or PF-6b *Roof penetration & above, and exterior exposed piping shall be P-6 only
Domestic Cold Water, underground	Within 5' from building, All sizes	P-5	PF-4a, or PF-4b
Domestic Cold Water, underground	Site distribution only, 4" and over	P-9; Refer to 33 1100	PF-9; Refer to 33 1100
Domestic Hot and Cold water, aboveground	Interior only	P-4	PF-4a, or PF-4b
Downspouts, Interior Storm Drainage	Within 5' from building, All sizes	P-1	PF-1a, or PF-1b
Exposed Downspouts, Interior Storm Drainage	Existing Buildings and aboveground only	P-2	PF-2
Fire Mains (Fire Hydrants), Underground	Site distribution only, 4" and over	P-9; Refer to 33 1100	PF-9; Refer to 33 1100
Fire Suppression System, Interior	All sizes	P7; Refer to 21 1313	PF-7d; Refer to 21 1313
Irrigation, After Backflow Preventer	All sizes	P14; Refer to 32 8413	PF-14; Refer to 32 8413
Irrigation, Meter to Backflow Preventer	Up to 4"	P-5; Refer to 33 1100	PF-4a, or PF-4b; Refer to 33 1100
Irrigation, Meter to Backflow Preventer	4" and over	P-9; Refer to 33 1100	PF-9; Refer to 33 1100
Irrigation, Reclaimed Water or Recycled Water	All sizes	P15; Refer to 32 8426	PF-15; Refer to 32 8426
Natural Gas, Exterior	Underground, site only	P-13	PF-13a, and PF-13b
Natural Gas, Interior, aboveground	All sizes	P-7	PF-7a, PF-7b, or PF-7c
Vents-ACID,	All sizes	P-6, P-10, P-11, or P-12 *Roof penetration & above shall be P-6 only	PF-6a, PF-10, PF-11a, PF-11b, PF-12a, or PF-12b

Use	Limits	Pipe	Fittings
			*Roof penetration & above: PF-6a only
Waste - ACID - Aboveground - Passing through Air Plenum	All sizes	P-11	PF-11a, or 11b
Waste - ACID - Aboveground - Fire-Rated	All sizes	P-12	PF-12a, or 12b
Waste - ACID - Aboveground	All sizes	P-10	PF-10
Waste - ACID - Underground	All sizes	P-6	PF-6a, or 6b
Waste - FORCED	All sizes	P-1	PF-1c
Waste and Vent - Indirect	All sizes	P-3	PF-3
Waste and Vent – Sanitary/ Grease	All sizes	P-1	PF-1a, or 1b
Waste and Vent – Sanitary/ Grease	Underground, site only	P-1; Refer to 33 3000	PF-1a, or 1b; Refer to 33 3000

M. Pipe Isolators:

PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe.

Manufacturer: Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator, or equal.

Manufacturer: Hydra-Zorb Cushion Clamps, Acousto-Clamp, or equal.

N. Pressure Gage: Aluminum or steel case, minimum 4 ¼-inch dial; pressure type or combination vacuum-pressure type, with provisions for field calibration. Dial indicator to indicate pressure in psi with accuracy to within plus or minus 0.5 percent of maximum dial reading. Furnish gages with restriction screw, size 60, to eliminate vibration impulses. Black case and ring, bourdon tube of seamless copper alloy with brass tip and socket. Three way gage cock, constructed of brass with stuffing box, 1/2 inch couplings, with fixed or movable cap nut to shut off pressure gage.

PG-1 Pressure type, black drawn steel case, 4-1/2-inch glass dial, range approximately twice line pressure.

Manufacturer: Marsh Keckley, Trerice, Weksler, Weiss, or equal.

O. Plug Valves:

PV-1 2 inches and smaller: Rockwell No.114, lubricated plug type, 200-pound., water operating gauge pressure iron body and plug, regular pattern, threaded, with indicating arc.

Manufacturer: Walworth, Homestead, WKM, or equal.

PV-2. 2 ½-inch and larger: Rockwell No.115 and No.165 lubricated plug type, 200 pound water operating gauge. Iron body and plug, regular pattern, flanged, with indicating arc.

Manufacturer: Walworth, Homestead, WKM, or equal.

P. Safety Relief Valves:

SRV-1: Combination temperature and pressure relief type. CSA approved. Set to open at 125 psi pressure.

Manufacturer: Watts: 40L, Cash-Acme: NCLX-1, or equal.

SRV-2: Same as SRV-1, except provide on storage type water heater with anode in dip tube.

Manufacturer: Watts: 100XL, Cash-Acme: NCLX-1, or equal.

SRV-3 Spring type, ASME and NB stamped and certified with manual lifting device for air or gas.

Manufacturer: Bailey, Cash-Acme, Watts, Keckley, or equal.

Q. Strainers:

STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blowout piping, same size as blowout plug.

1. 2-inch and smaller:
   C.M. Bailey No.100-A, 250 lb., cast iron body, threaded, Keckley: Style B, Spirax Sarco Y-type, or equal.

2. 2 ½-inch and larger:
   C.M. Bailey No.100-A, 125 lb., cast iron body, flanged, or Victaulic style 732, 300 psi, ductile iron body, grooved, fusion bonded epoxy coated.

   Manufacturer: C.M.Bailey, Armstrong, Muessco, Keckley 'A', or equal.

STR-2 Y pattern cast iron bodies, 125 psi, monel screen. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2 inches, flanged ends fusion bonded epoxy coated for 2 ½-inch and larger perforations, in accordance with the following:

1. Steam service - 40 square mesh.

2. Other services - 16 square mesh.

Bailey No.100, Armstrong, RP&C, Keckley or equal.

STR-3 Flanged, bucket type, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations, all sizes.

Manufacturer: Bailey No.1, Zurn 150 Series, RP&C, Keckley GFV, or equal.

STR-4 Grooved, T-pattern, ductile iron body, 300 psi, stainless steel frame and mesh basket, grooved ends.

R. Vent Caps:

VC-1 Vandal-proof hood type, for plumbing vent lines.

Manufacturer: Stoneman Engineering and Mfg., Semco 1550, or equal.

S. Vacuum Valves:

VV-1 Vacuum valves; for vacuum serve, 125 psig working pressure, cast iron body, spring loaded lubricated plug type.

Manufacturer: General Controls, Honeywell, Valmatic, or equal.

T. Protective Coating for Underground Steel Piping Applied to Underground Automotive:

1. Black steel or galvanized steel piping indicated for below grade installation, shall be protected as specified prior to delivery to the Project site:

    a. Sandblast black steel pipe to a gray finish. Sandblast galvanized steel pipe lightly only.

    b. Install one coat of cut back asphalt to galvanized pipe immediately after sandblasting. Pre-heat black pipe to 180 degrees F. immediately before coating.

    c. Install one coat of high-temperature (melting point of 240 degrees F. minimum) Grade B asphalt enamel.

    d. Install one wrapping of 20 mils thick glass, fiber mat, Owens-Corning Coromat or L.O.F. Blueflag with 1/4 inch overwrap. Glass fiber shall be dry at time of installation.

    e. Install a second coat of asphalt enamel as specified above. Glass fiber mat shall be centered in the asphalt enamel.

    f. Install an overwrap of Kraft ripple paper.

2. Total thickness of pipe wrapping shall be not less than 1/8 inch. Entire coating operation shall be accomplished by mechanical means in a continuous operation. Hand installation of protective coating is not permitted.

3. Each piece of wrapped pipe shall be legibly identified at no greater than 5 feet intervals by fabrication company. Each material submittal shall include the name of the fabrication company. Maintain one reviewed Sample on the Project Site.

4. Acceptable manufacturers of wrapping are: Hunt, Mobile, Conway or equal.

5. Fittings (including couplings), unprotected pipe adjacent to fittings, and damaged pipe protection shall be wrapped at Project site as follows:

    a. Fittings and pipe to be wrapped shall be thoroughly cleaned of material foreign to pipe manufacturer.

b. Install one coat of Plicoflex No. 105 or Protecto Wrap No. 1170 adhesive primer to metal.

c. Wrap pipe and fittings with a minimum thickness of 3/32 inch of Plicoflex No. 310 pipe line butyl molding tape, or Protecto Wrap No. 200 molding tape. Install 3 layers, each layer overlapping next approximately 2/3 width of tape, without stretching. Tape and primer shall be of the same manufacturer.

d. Wrap vinyl tape, 10 mil thickness, over molding tape with 1 inch minimum overlap.

Manufacturer: J.M. Trantex, 3M Scotchwrap or equal.

5. Pipe and fittings specified to be wrapped shall be tested with a holiday detector, after pipe has been installed in trench and before backfilling, in presence of the Project Inspector. Furnish a Tinkler and Raser model E-P holiday detector, or similar equipment for this test. Work, which is deemed defective, shall be repaired or replaced. The Project Inspector may test for damaged pipe wrapping after backfilling.

6. Instead of wrapping underground steel pipe as specified above, pipe may be machine-wrapped before delivery to the Project site as follows:

a. Pipe shall be cleaned of moisture, oil, grease, scale, and other foreign material by cleaning with non-oily solvent and wire brushing. Remove metal burrs and projections.

b. Install one coat of Plicoflex No.105 adhesive primer to cleaned pipe. If thinning is required, furnish only non-oily thinners as recommended by tape manufacturer.

c. Wrap coated pipe with Plicoflex No.340-25 tape (15 mil butyl and 10 mil vinyl laminate) Tape shall be installed by machine wrapping at approved plant only. Maintain tension (minimum of 5 pounds per inch of width) on tape over entire diameter of pipe. Tape shall be permanently identified and visible on vinyl side.

d. Fittings, unprotected pipe, and damaged pipe protection shall be wrapped as indicated above.

U. Flanges: Flanges shall be furnished and installed at each flanged connection of each type of equipment, tanks, and valves. Faces of flanges being connected shall be furnished alike. Connection of a raised face flange to a flat-faced flange is not permitted. Flanges shall conform to following schedules:

TYPE OF PIPE	FLANGE
Screwed black or galvanized grooved steel pipelines.	125-pound black cast iron screwed flange, flat faced or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Welded or grooved steel pipe, except high pressure steam lines.	150-pound black forged steel welding flanges, 1/16 inch raised face ASTM A 105, Grade II or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.

TYPE OF PIPE	FLANGE
Copper and brass pipe or tubing.	150 pound cast bronze, flat-faced flange with solder end or grooved flange adapters, Victaulic Style 641, Tyco-Grinnell Fig. 61, Gruvlok Fig. 6084, or equal.

1. Gasket material for flanged connections shall be full faced or ring type to suit facing on flanges and shall be furnished in accordance with following schedule:

SERVICE	TYPE
Cold water	1/16-inch-thick neoprene

Grooved end flange adapters supplied with pressure responsive elastomeric Gaskets supplied with grooved flange adapters shall be pre-lubricated by the manufacturer. Grade of gasket to suit intended service.

V. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):

a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.

b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.

c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.

d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the ARCHITECT.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the ARCHITECT, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the ARCHITECT.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between two or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, or equal, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the ARCHITECT.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Provide polished, chrome-plated flanges when plumbing pipes pass through walls at plumbing fixtures, etcetera as specified in Section 22 4000 Plumbing. Provide polished steel, chromium-plated split floor and ceiling plates at locations where pipes pass through walls, floors, ceilings, and partitions in finished portion that neatly conceals pipe insert.

8. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an OWNER-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the INSPECTOR with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an OWNER recognized, DSA approved testing laboratory.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

   a. Cracks of any type.

   b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

   c. Elongated slab inclusions longer than 1/4 inch.

   d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

   e. Undercuts greater than 1/32 inch.

   f. Overlaps, abrupt ridges or valleys.

3. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

4. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

5. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

6. OWNER shall cause to be performed additional random UT and radiographic examinations of welds. OWNER shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

7. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of 2 pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the OWNER in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM A53, Type B, steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

2. Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Hot tapping of gas lines is strictly prohibited.

3. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

    a. Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.

    b. Plastic Piping: Teflon pipe joint compound tape.

    c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.

    d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.

    e. Other services furnish sealant, suitable and as reviewed by the ARCHITECT.

4. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.

5. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

6. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3. Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added

until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

7. Pressed fittings for copper or copper alloy pipe or tubing shall have an elastomeric O-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, mechanically cleaned and reamed prior to joining to remove all burrs (interior and exterior) and restore full inside diameter and a smooth, chamfered exterior surface. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

O. Joints shall be Vic-Press 304TM, or equal, made with Victaulic Series ‘PFT’ tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Polyethylene (Plastic) Pipe:

1. Joints shall be installed by the heat fusion method, in accordance with manufacturer's recommendations and IAPMO installation standard IS 12, for natural gas.

2. Pipe Riser at Meter, Regulator and Building Wall: Prefabricated, anodeless type, utilizing a grade level transition between underground polyethylene pipe and gas supply steel pipe of riser outlet, R. W. Lyall Co., or equal. Below grade to above grade transition shall be installed in a welded, epoxy coated, steel casing.

3. Connections to Existing Pipe Line or Branch:

   a. Steel-to-plastic (PE): Provide manufacturer's prefabricated standard transition fitting, transition from epoxy-coated steel pipe to plastic, R. W. Lyall Co., or equal.

   b. Plastic-to-plastic, PVC to PE: Provide manufacturer's prefabricated standard transition fitting, transition from PVC to epoxy-coated steel pipe to PE; R.W. Lyall Co., or equal.

   c. Plastic-to-plastic, PE to PE: Provide manufacturer's standard fused tapping tee assembly with shut-off feature.

4. Provide PE reinforcing sleeves where PE pipe is fused to multi-saddles, service punch tee, reducing tees, transition fittings and anodeless risers.

Q. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

4. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

5. Valves for similar service shall be of one manufacturer.

6. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman, or equal.

7. Ball valves below grade in yard boxes shall have stainless steel handles.

8. Hose bibs in dense garden areas shall be ¾ inch in size with one hose bib in the lunch pavilion 1 inch in size. Other hose bibs shall be ¾ inch lock shield type. Bibs shall be furnished with vacuum breaker protection.

9. Safety valves and pressure relief valves shall have stamp of approval as required by ASME and shall be provided with annual test lever. Where a hot water storage tank is heated by means of a coil, pressure relief valve shall have a steam BTU discharge rating of the coil. Discharge pipe from safety or pressure relief valves shall be not less than one pipe size larger than inlet pipe size of valve. Discharge pipe shall terminate as indicated

and shall be free of traps. In addition to locations specified, pressure relief valves shall be installed in the following locations:

a. On discharge side of each pressure-reducing valve.

b. On each water heater connected to a hot water storage tank and other pressure vessels.

c. On cold water line to each water heater or hot water storage tank when there is a check valve, backflow prevention valve or similar device between water heater or hot water storage tank and meter or relief valve at the pressure reducing valve assembly.

d. On discharge side of each air compressor.

e. On each air receiver connected to an air compressor.

10. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

11. A combination temperature and pressure relief valve or combination of valves on each heating hot water storage tank. Temperature sending element shall extend into water inside tank.

12. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

R. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc., or equal.

S. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer's Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic

requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Hose faucets, compressed air outlets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.

3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.

5. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by ARCHITECT and DSA.

6. Burning holes in beam flanges or other structural members is not permitted without review by the ARCHITECT and DSA.

7. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

8. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco I beam, Fig.62 for maximum 1000 pounds.

    b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.

9. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco Fig.310 for maximum of 600 pounds.

    b. Tolco Fig. 309 for maximum of 1140 pounds.

10. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.

11. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes ½ inch through 2-inch, ½ inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and ¾ inch for 8-inch and 10-inch pipe.

12. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.

13. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

14. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

15. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

16. Vertical Piping:

    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

    b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

    c. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

    d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

17. Horizontal Piping:

    a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block, or equal. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

    b. Insulated steam and space heating hot water insulated condensate lines, insulated domestic hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Grinnell Figure 212, or equal, steel hangers with welded eye rods to permit hinge movement at point of attachment of hangers. Hinge movement at point of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Grinnell Figure 278, or equal.

    c. Domestic cold water piping, water supply and return piping, condenser water piping, insulated refrigerant piping gas piping, compressed air piping, cast iron

soil piping, galvanized steel vents, waste and downspout piping and glass to be supported with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.

d. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

18. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

19. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

20. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

T. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Install caps on top of heater pipes. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct. No soldered joints on roof flashings will be allowed. No Stoneman lead roof flashings will be allowed.3. Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 8 inches.

3. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

4. Cast iron, steel, brass, and copper pipe, which terminates less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

5. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of ¾ inch.

6. Flashing and flanges on ducts shall be installed waterproof at point of connection to the duct by riveting and soldering. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

7. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

U. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 0548 even if not indicated on Drawings.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:

1. Division 01: General Requirements

2. Section 22 0513: Basic Plumbing Materials and Methods.

3. Section 22 1000: Plumbing.

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

2. APWA: Uniform Color Code.

3. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	Length of Color Field (in inches)	Size of Letter (in inches)
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½

over 10	32	3 ½

D. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	**Legend**	**Background Color**	**Lettering Color**
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot-water 140ºF	Domestic H.W. 140ºF	Blue	Black
Sanitary waste	San waste	Green	White
Sanitary vent	San vent	Green	White
Storm drain or downspout	Storm drain	Green	White
Indirect drain	Ind drain	Green	White
Sump pump discharge	Pump discharge	Green	White
Fire sprinkler supply	Fire Sprinkler supply	Red	White
Fire sprinkler drain	Sprinkler drain	Red	White
Fuel oil	Diesel oil	Yellow	Black
Gas	Gas	Yellow	White
Reclaimed Water	Caution: Reclaimed Water Do Not Drink (1)(3)	Purple	Black

H. Notes on Schedule:

1. Note (1) indicates 2 ¼ inch by 1 inch yellow label with ½ inch letters reading UNSAFE WATER at one end of primary label.

Note (2) words should read “CAUTION: NONPOTABLE WATER DO NOT DRINK.” with international *do not drink* symbol.

Note (3) words should read “CAUTION: RECLAIMED WATER DO NOT DRINK.” with international *do not drink* symbol.

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

a. Yellow: Oil and gas.

b. Blue: Water, irrigation and slurry lines.

c. Green: Sewer and drain lines.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistant insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 22 10 00

PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 22 0513: Basic Plumbing Materials and Methods.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.03 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.04 PRODUCT HANDLING

A. Conform to provisions of Section 22 0513: Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.01 PIPING SYSTEMS

A. Materials: Refer to Section 22 0513: Basic Mechanical Materials and Methods.

B. Insulation for Piping: Refer to Section 23 0700: Plumbing Insulation.

2.02 FIXTURES AND DRAINS

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel, and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:

1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.

2. Finished and exposed brass equipment, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:

1. Fixture traps shall be all cast brass, chromium-plated and polished. **(No tubular traps).** Exceptions as follows:

   a. Traps that are an integral part of a fixture.

   b. Traps concealed in floors, walls and furring.

   c. Traps standard for service sinks and Industrial Shop equipment.

   d. Laboratory traps and tailpieces shall be as specified in section 22-0700 “Basic Plumbing Materials and Methods”.

2. Concealed traps and 17 gage tailpieces may be rough brass finish, except as otherwise specified. Laboratory traps and tailpieces shall be as specified in Section 22 0700: Basic Plumbing Materials and Methods. Furnish chromium-plated and polished cast brass wall flanges with setscrews and chromium-plated and polished brass casing on discharge side of each trap.

3. Tailpieces shall be not lighter than 17 gage, brass, chromium-plated, and polished. Furnish and install chromium brass plated wall flanges with set screws and chromium-plated 20 gage brass casing on discharge side of each chrome-plated all cast trap.

D. Faucet and Shower Valve Handles: Faucet and shower valve handles shall be solid brass, chromium-plated and polished, and fastened to their stems by Allen type hollow head stainless steel set screws through the side of the handle extending into the stem. Handles with sharp edges or projections shall not be furnished. At accessible fixtures: handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate handles shall be 5 pounds maximum.

E. Fixture Supplies:

1. Supplies for water heaters shall be unplated rigid copper water tube with threaded adaptors for connections to valves and other threaded connections. All other supplies shall be chromium-plated brass with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

2. Exposed supplies for showers shall be chromium-plated brass pipe up to header with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

3. Supplies to water closet tanks, lavatories, and drinking fountains shall be furnished with chromium-plated and polished screwed type angle compression stops with square shank stems and lock shields extending beyond stem. Instead of solid supply piping, polished chrome-plated risers of 3/8 inch outside diameter with ferrule stop end and metal nosepiece may be furnished. The installation of braided stainless or easy hooker's supplies is not permitted. Exception: Supplies that rise vertically from floor shall be furnished with straight type instead of angle type stops.

4. Each supply or pipe that penetrates a finished surface and plumbing pipes passing through a countertop or part of a cabinet shall be furnished with a chromium-plated brass flange except flanges furnished by manufacturer of flush valves as an assembly.

5. Water supplies of plumbing fixtures shall be protected against back-siphonage in event of a vacuum in piping system.

6. Discharge outlets of supply faucets for lavatories and sinks shall clear top of overflow rim by at least one inch.

7. Toilet and urinal flush valves shall be furnished with recognized atmospheric vacuum breakers, installed a minimum of 6 inches above fixture.

2.03 FIXTURE CONNECTIONS

A. Branches to individual fixtures shall be of the following sizes (Inches) unless larger sizes are indicated on Drawings:

Fixture	Copper, Cold (Inches)	Copper, Hot (Inches)	Trap and Connections (Inches)	Soil/ Waste (Inches)	Vent (Inches)
WC Flush Valve	1	N/A	4	4	2
Lavatories	1/2	1/2	1-1/2 by 1-1/4	2	1-1/2
Service Sink	1/2	1/2	2	2	1-1/2
Kitchen Sink	1/2	1/2	1-1/2 by 1-1/2	2	1-1/2
Classroom Sink	3/8	3/8	1-1/2 by 1-1/2	2	1-1/2
Wash Sink	3/4	1/2	1-1/2 by 1-1/2	2	1-1/2
Multiple Drinking Fountains	3/8	N/A	1-1/2 by 1-1/2	2	1-1/2
Single Drinking Fountains	3/8	N/A	1-1/2	2	1-1/2
Individual Showers	1/2	1/2	2	2	2
Standard Urinals, Wall-Hung Flush Valve:	3/4	N/A	N/A	2	1-1/2
Access Compliant Urinals, Wall-Hung Flush Valve:	1	N/A	N/A	2	1-1/2
Sillcocks	3/4 minimum	N/A	N/A	N/A	N/A

B. Water headers serving water closets shall be copper water tube, with following size throughout length:

1. 1-1/2 inches for 2 flush valves.

2. 2 inches for 3 to 9 flush valves.

C. Water headers serving urinals shall be of following size throughout length:

1. 1” for 1 or 2 flush valves.

2. 1-1/4” for 3 flush valves.

3. 1-1/2” for 4 to 8 flush valves.

D. Water headers serving showers shall be same as listed above for urinals.

E. Water headers serving lavatories shall be of following size throughout length:

1. 1/2 inch for 2 lavatories.

2. 3/4 inch for 3 and 4 lavatories.

3. One inch for 5 and 6 lavatories.

2.04 HEIGHT OF FIXTURES

A. Heights for standard fixtures.

Fixture	Adult and High School (Inches)	Secondary (Inches)	Elementary (Inches)	Kindergarten and Younger (Inches)
Water Closets	15 to 17	15 to 17	15	10
Lavatories	32	32	30	25
Drinking Fountains	38 to 43	40	32	30
Wash Sinks	30	30	28	24
Urinals, lip height	24	21	18	N/A
Shower Heads Male (Student and Instructor) From tip of shower head to finish floor.	72	60		
Shower Heads Female (Student and Instructor) From tip of shower head to finish floor.	72	60		
Shower valves	48	48		

B. Heights for access compliant fixtures.

Fixture	Adult Ages 12 and Over (Inches)	Elementary Ages 6 to 11 (Inches)	Kindergarten and Younger Ages 3 to 5 (Inches)
Toilets, center line from wall	17 to18	15	12
Toilets, height to top of seat	17 to 19	15	10 to 12
Lavatories, sink top height	34 maximum	29 maximum	24 maximum
Lavatories, sink knee clearance	27 minimum	24 minimum	19 minimum
Urinals, lip height	17 maximum	15 maximum	13 minimum
Urinals, flush handle height	44 maximum	37 maximum	32 maximum
Drinking fountains, bubbler height.	36 maximum	32 maximum	30 maximum
Drinking fountains, knee clearance	27 minimum	24 minimum	22 minimum
Wash Sink	Per Drawings		
Shower Valves	Per CBC		
Shower Seat	Per CBC	Per CBC	Per CBC
Shower Head (adjustable) Bar	Per CBC		

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Unless otherwise specified, plumbing fixtures, equipment and appliances that require connections to plumbing line shall be connected. This shall include fixtures specified or indicated as furnished by others, furnished by Owner, or specified in other related sections. Install supplies, stops, valves, traps, wall flanges, or pipe casing for connection of this equipment.

2. Install equipment as indicated on reviewed and accepted Shop Drawings.

3. Avoid interference with Work of other trades. Do not deviate from Drawings without review of the Architect.

B. Examination: Check each piece of equipment in system for defects verifying that parts are properly furnished and installed.

C. For piping Work, refer to Section 22 0513: Basic Plumbing Materials and Methods.

D. Plumbing Fixture and Equipment Installation:

1. Unless otherwise indicated, fixtures shall be installed with 5/16 inch brass bolts or screws of sufficient length to securely fasten fixture to backing, wall, or closet ring.

2. Fixtures installed against concrete or masonry walls shall have their hangers fastened with 5/16 inch brass bolts, Philip Shield type anchors, or 2 unit cinch anchors. Wood or plastic plugs are not permitted.

3. Fixtures installed against wood or metal stud walls shall have their hangers fastened to metal backing plates with 5/16 inch brass bolts screwed into plate. Fixture hangers for urinals shall be fastened centered vertically on metal backing plate with three 5/16 brass bolts each for small individual hangers and six, for larger one piece hangers. Lavatories shall be hung with not less than four 5/16 inch brass bolts or not less than five 1/4 inch brass bolts. Each sink hanger shall be hung with not less than four 5/16 inch brass bolt or not less than five 1/4 inch brass bolts.

4. Pan type drinking fountains shall be hung with 5/16 inch cadmium plated bolts with a bolt in each bolt opening in hanger. Hangers for pan type drinking fountains shall provide 2 inches (plus or minus 1/4 inch) between pan and wall. Spaces due to irregularities between fixtures and tile walls shall be neatly filled with white cement or silicone filler.

5. Backing for hanging of plumbing fixtures and equipment shall be installed in supporting wall at time rough piping is installed. Backing for stud walls shall be steel plate 1/4 inch thick, not less than 4 inches wide. Backing for urinals shall be ¼-inches thick by 6-inch wide steel plate. Steel plate shall be attached to stud at each end of plate and to each stud it crosses. Plate shall be attached to metal studs by bolting with two ¼ inch U-bolts per stud with bolts through plate and around stud flange or by welding with a 1/8 inch fillet weld full width of stud flange, top and bottom of plate. At wood studs, plate shall be carefully recessed flush with face of stud and attached to each stud with 2 No. 14 flat-head wood screws, 2 inches in length into pre-drilled 1/8 inch holes. Backing for stud walls supporting wall-hung closets shall be as detailed.

6. Rough-in for fixtures, equipment and appliances shall be as indicated on Drawings and as specified, including those items indicated as furnished by others, furnished by Owner, or future capacity. When connections to equipment from capped or plugged lines are required, caps or plugs shall be removed at time equipment is set and stops or valves installed and connections provided as specified.

7. Piping materials for trap arms shall be Brass, Cast Iron or DWV copper

8. Piping shall be stubbed out to exact location of fixtures and stubs shall be installed symmetrical with fixtures. Hot and cold water supplies for center set faucets on lavatories shall be installed on 8-inch centers, unless otherwise specified or required.

9. Kitchen equipment requiring backflow protection with hot and cold water connections shall be installed with approved backflow prevention assemblies; BPV-3 and drain into floor sink with air gap.

E. Cleanouts in Drain, Waste, Vent and Sewer Lines:

1. Cleanouts shall be installed at locations stated in the California Plumbing Code and accessible at following locations:

   a. At locations above first floor as stated on construction documents and 5 feet outside of the building.

   b Install an accessible main line upper terminal cleanout in all restrooms above water closet over flow. (Install above upper terminal water closet where there are more than one water closet in a restroom).

   c. Above faucets of each sink with brass plug.

   d Above service sink with brass plug.

   e. At each Drinking Fountain with brass plug.

   f. At each urinal and locate above urinal with brass plug.

   g. Above overflow level of pot sinks with brass plug.

   h. In vertical line at base of each downspout connected to an underground storm drain system extend cleanout to exterior of building.

   i. At upper end of a horizontal vent line when any part of horizontal line is below overflow level of fixture it serves.

   j. Not to exceed 100-foot intervals in sewer and waste lines exterior of building.

   k. At property line connection.

   l. Where indicated on Drawings.

2. Cleanouts shall be extended to grade as follows:

a. Not to exceed 100-foot intervals in straight runs of pipe outside buildings.

b. At horizontal changes of direction in aggregate greater than 135 degrees (underground).

c. At property lines.

d. Where cleanouts occur under concrete.

e. Where marked for future connections.

3. Cleanouts in building shall be extended to floor level or above floor level or above floor level in walls or furring when cleanouts are not accessible or where clearance is less than 18 inches.

4. Cleanouts in finished areas in building shall be concealed except that cleanouts above service sinks in janitor's rooms or closet, and cleanouts above service sinks or in exposed piping in boiler or heater equipment rooms, may be exposed. Cleanouts for urinals shall be installed above urinal and shall terminate behind an access plate.

5. Cleanouts in floors of covered areas and those extended to grade in concrete areas shall be floor level type with extensions body brass plugs and detachable nickel-bronze or aluminum alloy scoriated.

6. Concealed cleanouts in vertical lines shall be service weight soil cleanout tees with brass plugs and round cover plates unless otherwise specified or indicated. A snug fitting sleeve of galvanized sheet metal shall be placed around hub of tee and shall extend to flush with finished soil, or cleanout shall be extended to finished wall.

7. Cleanouts extended from below floor to a wall or furring or on horizontal lines above floor that terminate at a wall or furring shall be iron body type with brass plugs and round cover plates.

8. Cover plates over cleanouts in painted walls shall be steel, bonderized and prime coated. Cover plates cover cleanouts in tile walls shall be chromium-plated brass or nickel bronze. Plates shall be attached to cleanout plugs with 5/16 inch No. 18 or 1/4 inch No. 20 stainless steel vandal-proof type screws. Plates shall be one inch larger in diameter than fitting opening.

9. Cleanouts at bases of downspouts shall be tapped soil tees with brass plugs as hereinafter specified, full size of line.

10. Cleanouts extended to grade in exterior sewer lines other than floors or concrete areas shall be a cleanout assembly with secured top, extra heavy-duty, adjustable sleeve, cut-off ferrule, countersunk threaded brass plug and scoriated tractor type cover.

11. Other cleanouts shall be iron body type.

12. Cleanout extensions shall be no-hub cast iron soil pipe. Exterior cleanouts, those in concrete excepted, shall terminate in a 14-inch by 6-inch thick concrete block with cleanout assembly and top of block flush with finish grade.

13. Fittings in lines utilized as cleanouts shall be approved soil fittings including no-hub pipe. Tees and crosses in vent headers excepted.

14. Pipe joint compound shall not be installed on cleanout plug. After lines are tested and approved, each cleanout plug shall be removed, greased, and replaced.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform trenching, excavation, and backfilling required for Work of this section as specified herein and in Section 31 2323: Excavating, Backfilling, and Compacting for Utilities.

3.04 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and provide proper connections.

B. Potable water lines shall be purged completely before connecting to sources of water for the Project. Determine quality of water supply before connection.

3.05 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on Drawings and in following locations (only non-ferrous arrestors may be installed in copper water system):

1. Water lines to lavatory headers, water closet and urinal headers, service sinks, kitchen sinks, wash fountains, drinking fountains, laboratories with medical type faucets and on wash sinks having three or more stations and all other quick closing fixture such as clothes washers, as close to fixture as possible.

2. Between last two fixtures when three or more fixtures, other than those listed in Number 1 above, are served by a common header.

B. When possible, arrestor shall be installed in wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of arrestor. Access plate shall be a minimum of 2 inches larger in each direction than the arrestor.

C. Fixture water lines shall be provided with mechanical water arrestor hammer dampening devices. Air chambers are not approved.

3.06 CONDENSATE DRAINS - FROM AIR CONDITIONING UNITS

A. Connect drain piping from drain pan of air conditioning unit to condensate disposal location indicated. When coil or unit housing is shock or vibration isolated, connection shall be furnished through a flexible connector not less than 10 inches long. Drain line shall pitch to flow out at not less than one inch in 8 feet. Drain line shall not be reduced smaller than unit outlet connection.

B. Condensate drain piping installed within building whether in air conditioned space or not shall be insulated. Refer to Section 22 0700: Plumbing Insulation, for type of material required.

C. Condensate Trap:

1. A condensate trap shall be installed for each air conditioning coil. Trap shall be assembled from 2 brass unions: one between A/C unit and inlet of trap, and one at outlet of trap that connects to main drain.

2. Trap configuration shall be per manufacturer's recommendations based on total unit casting static pressure (simulated plugged filter condition), but not less than 3 inch water seal.

3. Running trap design is not permitted.

4. Secondary drain shall not be trapped.

D. Condensate trap shall be checked at equipment operational tests for proper water drainage flow from air conditioning unit. Cooling condensate pan shall be filled with water, filters covered with plastic (plugged filter simulated), unit panels replaced, and unit motor running at design condition. Pan shall drain without hesitation to bottom of inlet connection. Tests are made prior to installation of ceiling.

E. Secondary Overflow Drain:

1. Drain pan installed underneath air conditioning units in concealed ceiling space or units that incorporate dam fitting shall be furnished with secondary drain piped to outside planter area with outflow location clearly visible.

2 If outside building location is not available or feasible, secondary drains shall be piped to a classroom sink, if sink is not available pipe to a room corner away from cabinets, computers, desks, door ways/entrances or stairs.

3 Secondary vertical pipe that penetrates through suspended ceiling shall be furnished with a coupling or threaded adapter so ceiling tile can be removed without damage.

3.07 3.07 CONDENSATE DRAINS - FROM WINDOW TYPE HEAT PUMP AND EXTERIOR WALL MOUNT HEAT PUMP UNITS

A. Whether indicated on Drawings or not, window units and wall mount units without built in bottom drain pan for evaporator and condenser coils shall be provided with galvanized steel condensate pan at bottom of unit with drain line that drains into approved drywell. Install copper 1/2 inch diameter pipe for window type air conditioners and 3/4 inch diameter pipe for exterior wall-mounted heat pump units.

3.08 MAKE-UP WATER SYSTEMS

A. Provide and connect make-up water systems for equipment in other sections.

3.09 CLEANING - PLUMBING PIPING SYSTEMS AND FIXTURES

A. Plumbing lines and fixtures shall be flushed to remove dirt and foreign material until water runs clear and no foreign substance or odor is present. Strainers and screens on faucets shall be removed during this cleaning operation.

B. After satisfactory cleaning of strainer and screen replacements has been witnessed by the Project Inspector, post and maintain signs stating: "CAUTION - Water at this construction project has not yet been certified for human consumption." Signs shall be furnished with letters at least 1/2 inch in height, and shall be conspicuously posted at entrances to the Project site. Signs shall be paneled, black and yellow, in conformance with OSHA Section 1910.1455.

3.10 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:

1. Lead free complying with AB1953.

2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

C. Valves shall be accessible and installed within an access panel approximately 3 feet above floor and no more than 7 feet above floor, or in a marked yard box to prevent tampering.

1. Immediately after each water meter, in addition to any valve furnished by utility company, there shall be an accessible valve on the inlet side for a strainer assembly, dual backflow device assembly and/or possibly a dual pressure reducing valve assembly.

2. A gate or ball valve on each water supply before it enters building. Valves shall be accessible from outside building and shall be installed in a marked yard box, unless otherwise indicated on drawings. Ball valves 2 ½-inch size or larger shall omit gate valve handle and furnish 2-inch square operating nut.

3. At multi story buildings, provide an isolation-valve or multiple valves for both hot and cold water in access panel to isolate and control each floor level.

4. For classrooms, shops, offices and boiler or mechanical room, install a gate or ball valve to control hot and cold water lines to each group of fixtures, a group of fixtures shall be considered to be 2 or more fixtures in the same room. When practical, valves shall be installed on the same wall as group of fixtures. Valves shall control only fixtures in rooms in which they are installed.

5. For restrooms, a gate or ball valve shall be installed in each restroom to isolate the hot and cold water supply into a restroom regardless of the number of fixtures. These valves shall control and be accessible only from within the restroom in which fixtures are installed. Valves shall be installed on the same wall as the group of fixtures it serves. Valves shall control only fixtures in restroom in which they are installed. Back to back restrooms shall be isolated separately and individually.

6. Install a gate or ball valve on each building branch line, which serves two or more fixtures, when these fixtures are not provided with a group isolation valve as specified above. These valves shall be located approximately 3 feet but not more than 7 feet above finish floor.

7. Install a gate, ball valve or partition stop for a drinking fountain or a group of drinking fountains.

8. Install a gate, ball valve or partition stop for hot and cold water supply to plumbing fixtures with no accessible supply stops, such as wall mounted faucets.

9. Install a gate, ball valve or partition stop for stops adjacent to, and controlling water flow to each sill cock and hose bib except as follows:

   a. A sill cock immediately below an exterior drinking fountain may be controlled by the same gate, ball valve or partition stop as drinking fountain.

   b. Valves or stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only hose bibs and branch line is furnished with a shut-off valve.

10. Install a lose key angle stop, on each exposed fixture supply, and for each flush valve unless otherwise specified,

11. Install gate or ball valve at each location where a water line is connected to a piece of equipment other than items mentioned above.

12. Install a check valve on each hot water return line where it connects to a hot water storage tank or a water heater.

13. Handles, hand wheels (including dishwasher fill valve handles) and operating nuts shall be furnished of steel, brass, or cast iron and shall be removable. Unless specified to be loose key type, handles shall be securely fastened to their stems. On exposed outdoor valves, omit operating handles and provide operating nuts.

14. Provide a handle or a key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver them to the project OAR.

3.11 ELECTROLYSIS PREVENTION

A. Brass nipples, 6 inches, with recognized brass unions; flanges shall be furnished and installed at locations described herein. Flanges shall be installed with complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at following locations:

1. Where special applications indicated on Drawings require an insulation flange or brass union, with 6-inch brass nipple to be installed in a condensate line, or steam line, flange insulation shall be of a high temperature type, suitable for continuous operation at temperatures up to 220 degrees F. for condensate and 400 degrees F. for steam.

2. Where steel or cast iron in ground connects to copper or brass piping above ground, transition from steel or cast iron pipe to copper or brass pipe shall be provided in an accessible location.

3. Underground dielectric connections shall be furnished in accessible yard boxes.

4. Above ground dielectric connections shall be exposed; or if in finished rooms shall be located in accessible access boxes.

3.12 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished according to Section 22 0553: “Plumbing Identification”

B. Under ground Caution Tape shall be placed 12 to 18 inches above the utility line. The Caution Tape shall be a designated color and marked with the appropriate name for the specific type of utility pipe as follows:

1. Yellow – with the words: CAUTION GAS LINE BELOW

2. Blue – with the words: CAUTION WATER LINE BELOW

3.13 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.14 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose off Project site.

3.15 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 00 01
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section provides the Basic Electrical Requirements, which supplement the General Requirements of Division 01 and apply to all Sections in Division 26.

1.02 RELATED SECTIONS

A. Excavating, Backfilling and Compacting for Utilities: Divisions 31, 33.

B. Cast-in-Place Concrete: Division 03.

1.03 BASIC ELECTRICAL REQUIREMENTS

A. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Electrical Drawings are essentially diagrammatic. Size and location of equipment is indicated to scale whenever possible. Contractor shall verify all conditions, data and information as indicated on Drawings and in Specification Sections where electrical work is required.

2. Electrical Drawings indicate required size and points of termination of conduits, number and size of wires, and suggest proper route for conduit It shall be responsibility of Contractor to install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and meet all applicable code requirements. Routing of conduits may be changed, if approved by the District Electrical Inspector, provided that the length of any conduit run is not increased or decreased more than 10% of length indicated on Drawings.

3. It is intended that outlets be located symmetrical with Architectural elements notwithstanding fact that locations indicated on Drawings may be distorted for clarity.

4. Architectural and Structural Drawings take precedence over Electrical Drawings in representation of general construction work Drawings of various trades take precedence in representation of work of those trades. Contractor shall refer to all Drawings to coordinate the Electrical work with work of other trades.

B. Terminology:

1. Term “signal system” shall apply to clock, bell, fire alarm, annunciator, sound, public address, buzzer, public telephone, television, inter-communication, and security systems.

2. Term “low voltage” shall apply to systems operating at 600 volts and under.

3. Term “high voltage” shall apply to systems operating at more than 480 volts.

4. Term “medium voltage” shall apply to systems operating at more than 24 volts but less than 480 volts.

5. Term “provide” used on Drawings and elsewhere in the Specifications shall be considered to mean “furnish and install”.

6. Term “UL” means Underwriters Laboratories, Inc.

C. Ordinances and Regulations:

1. Electrical work shall meet requirements of local authorities having jurisdiction including municipal ordinances, City Building code, the California Code of Regulations, Title 24, the Safety Orders of the State Division of Industrial Safety, and the Fire and Panic Safety Standards of the State Fire Marshal. Material and labor shall conform to Regulations of the National Board of Fire Underwriters for Electrical Wiring and Apparatus. All new material shall be “UL” listed.

2. Electrical work shall meet requirements of latest California Electrical Code as indicated and specified.

D. Structural Considerations for Conduit Routing:

1. Where conduits are to pass through or will interfere with any Structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, to accommodate the electrical work, such work shall conform to State Building Code, Part 2, Title 24, Section 2606 for conduits and pipes embedded in concrete and Section 2517 (g) 8, 9, for notches and bored holes in wood; for steel, as detailed on the Structural Drawings.

2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall, rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include manholes, pull boxes, vaults and buildings.

3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled and conduit nipple or coupling shall be welded to poles. Welds shall be by the electric arc process and shall be continuous around nipple or coupling.

E. Electrically Operated Equipment and Appliances:

1. Equipment and Appliances Furnished by Contractor:

a. Electrical work shall include furnishing and installing wiring enclosures for, and the complete connection of all electrically operated equipment and appliances and any electrical control devices which are specified to be furnished and installed in this or other Electrical Sections of these Specifications, except Electrical work specified or indicated to be in the Mechanical work. All wiring enclosures shall be installed concealed except where exposed work is indicated on Electrical Drawings.

b. Connections shall be made as necessary to completely install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets of incorrect Electrical characteristics or if any equipment fails to operate properly, Contractor shall report to the District’s Inspector in writing, listing buildings and rooms in which located, the name, make and serial number of equipment, and a description of defect.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as N.I.C. (Not in Contract), “Furnished by Others”, or “Furnished by the District”, will be delivered to the Site. Required electrical connections shall be made for all such equipment and appliances in accordance with accepted trade practices under direction of the District Electrical Inspector. All motorized equipment will be furnished factory wired

to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under other Sections of this Specification shall be part of the Electrical Work. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and other Sections of this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete Electrical installation. Work shall also include furnishing and installing conduit and outlet box, if needed for control system, furnished under Mechanical. Devices and equipment furnished shall be of same type used elsewhere on job or as specified.

c. Electrical equipment furnished under other Sections of this Specification for installation and connection under work of this Section shall be delivered to the installation location by the Contractor furnishing the equipment.

d. Suitability and condition of equipment furnished by other Sections of this Specification shall be determined in advance of installation. Immediate notice of damage, unsuitability or lack of parts shall be given to the Architect.

F. Protection of Materials: Provide for safety and good condition of all materials and equipment until final acceptance of project by the District Protect all materials and equipment from damage and provide adequate and proper storage facilities during progress of work all damaged and defective work shall be replaced prior to final inspection.

G. Cleaning

1. Exposed parts of electrical work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean all parts of apparatus and equipment. Exposed parts that are to be painted shall be thoroughly cleaned of cement, plaster and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and all corners and cracks scraped out. Exposed rough metal work shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

3. Contractor shall remove from the Site all debris and rubbish caused by the electrical work. He shall thoroughly clean building of dirt, debris, rubbish, marks, etc., caused by performance of work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSTALLATION OF EQUIPMENT AND APPLIANCES

A. Provide conduits required per Divisions 23 and 26 requirements.

B. Conduit stubs for equipment shall be terminated in a coupling flush with finished floor and shall be extended with rigid metallic conduit to a motor starter or junction box on the equipment.

C. If connection is from a flush wall-mounted junction box, install a weatherproof universal box extension and adapter by Bell Electric Company, and extend with rigid metallic conduit to motor starter or junction box on equipment.

D. All exposed final connections to equipment shall be by a watertight flexible conduit, unless otherwise indicated. A maximum of 36” of flexible conduit may be used except that all extensions from flush floor couplings shall be rigid conduit to a distance not less than 6” above floor.

E. Flexible conduit for all motors, shop and cafeteria equipment and other equipment, including HVAC equipment, shall be liquid-tight, flexible conduit, and shall contain a code size insulated green bond wire.

F. All exposed conduit shall be run vertically and horizontally following general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe straps.

G. Connectors for flexible steel conduit shall be the type which threads into convolutions of conduit Connectors for water-tight flexible metal conduit shall be approved for such use and shall be installed to make a watertight connection.

END OF SECTION

SECTION 26 00 03
RACEWAYS, BOXES & FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Provisions and Division 01 Specification sections, apply to this Section.

B. Specification Sections 17010 and 17050 apply to this Section.

1.02 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, and set up of the Communications System Raceway, Conduit and Backbone work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working raceway systems.

B. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter “support”) of the Work of this Section. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

C. Work:

1. Provision of all low voltage Communications Systems Raceway, Boxes and Fittings as defined on CSO.1 and shown on CS drawings. Includes:

a. Conduit and fittings.

b. Device boxes.

c. Pull and junction boxes.

d. Supporting devices.

1.03 COORDINATE

A. In addition to the requirements of Division 26, coordinate:

1. Interface to surface raceway installed by Division 26.

2. Cabling and bend radius requirements of Division 26 Sections.

B. Related Work in Other Sections:

1. Division 31: Trenching, Backfilling and Compacting

2. Division 07: Fire Stopping

3. Division 07: Joint Sealants

4. Division 27: Communications, General Provisions

5. Division 27: Communications, Basic Systems and Methods

6. Division 27: Communications, Wires, Cables & Related

7. Communications, Cabinets & Enclosures

1.04 QUALITY ASSURANCE & REFERENCES

A. Comply with the requirements of the following:

1. Listings/Approvals, General:

a. Provide Underwriters' Laboratories, Inc. listed and labeled equipment for all items for which U.L. carries a listing or labeling, unless items are specifically exempted.

b. Provide in accordance with latest edition of the California Electrical Code, as applies.

2. American National Standards Institute (ANSI)

a. ANSI C80.11990 Rigid Steel Conduit - Zinc Coated

b. ANSI C80.31991 Electrical Metallic Tubing – Zinc Coated

c. ANSI C80.51990 Rigid Aluminum Conduit

3. National Electrical Manufacturers Association (NEMA)

a. NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems

b. NEMA RN l 1989 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

c. NEMA TC 2 1990 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

d. NEMA TC 31990 PVC Fittings for Use with Rigid PVC Conduit and Tubing

e. NEMA TC 141984 (R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings

f. NEMA VE l Metallic Cable Tray Systems.

4. Underwriters Laboratories, Inc. (UL)

a. UL l 1993 Flexible Metal Conduit

b. UL 6 1993 (Bul. 1993) Rigid Metal Conduit

c. UL 360 1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit

d. UL 514A 1991 (R 1993) (Bul. 1993) Metallic Outlet Boxes

e. UL 514B 1989 (Errata 1991) (R 1993) (Bul. 1993) Fittings for Conduit and Outlet Boxes

f. UL 514C 1988 (R 1989) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

g. UL 651 1989 (R 1989) (Bul. 1993) Schedule 40 and 80 Rigid PVC Conduit.

h. UL 797 1993 (R 1993) Electrical Metallic Tubing

i. UL 1242 1983 (R 1993) (Bul. 1993) Intermediate Metal Conduit.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide the following type of conduit systems listed by their commonly used generic name. For all products not referenced herein, refer to the requirements of Division l6.

2.02 RACEWAY

A. Rigid Steel Conduit.

1. Drawing and Spec Reference: RSC.

2. Construction.

a. Trade standard dimension

b. Hot dipped galvanized after threading.

3. Approvals:

a. ANSI C80.1

b. UL-6

4. Acceptable:

a. Any meeting listing and approval.

B. Coated Rigid Steel Conduit:

1. Drawing and Spec Reference: CRSC.

2. Construction:

a. Trade standard dimension.

b. 40 mil. min. factory applied polyvinyl-chloride coating bonded with exterior surface of RSC type conduit.

c. Fittings used in Type CRSC conduit to employ identical coating as conduit. Fittings over-sleeve to extend l conduit diameter or 1-1/2” beyond fitting, whichever is less.

3. Performance:

a. Tensile Strength: 3500 psi.

4. Approvals:

a. NEMA RN1 (Type 40 - 40 mils thick)

5. Acceptable:

a. Plastibond by RobRoy Industries.

b. Occal-40 by Occidental Coating Company.

c. KorKap by Plastic Applicators.

C. Intermediate Metallic Conduit

1. Drawing and Spec Reference: IMC.

2. Construction:

a. Trade standard dimension

b. Hot dipped galvanized.

3. Approvals:

a. UL 1242, zinc coated steel only.

4. Acceptable:

a. Any meeting listing and approval.

D. Electrical Metallic Tubing.

1. Drawing and Spec Reference: EMT.

2. Construction:

a. Trade standard dimension

b. Electro galvanized.

3. Approvals:

a. ANSI C80.3

b. UL 797

4. Acceptable:

a. Any meeting listing and approval.

E. Flexible Conduit:

1. Drawing Reference: FLEX

2. Construction:

a. Flexible steel, zinc coated on both inside and outside by hot-dipping process.

b. Interlocking spirally wound steel strip.

c. 3/4” minimum size.

3. Approvals:

a. UL l

4. Acceptable:

a. Any meeting listing and approval.

F. Flexible Conduit, Armored:

1. Drawing Reference: LTFLEX

2. Construction:

a. Flexible steel, zinc coated on both inside and outside by hot-dipping process.

b. Interlocking spirally wound steel strip.

c. Coated with extruded polyvinyl covering.

d. 3/4” minimum size.

3. Approvals:

a. UL 360.

4. Acceptable:

a. Any meeting listing and approval.

G. PVC CONDUIT.

1. Drawing and Spec Reference: PVC.

2. Construction:

a. 4” trade diameter, unless otherwise noted.

b. Poly-vinyl chloride.

c. Application.

1) Soil Backfill - Schedule 40.

2) Concrete Encasement - PVC Type DB-120.

d. Elbows.

1) Where innerduct liner is scheduled - CRSC.

2) Elsewhere, Schedule 80.

e. 90º C rated.

f. Solvent welded joints, joints by pipe manufacturer.

3. Performance:

a. Tensile Strength: 7,000 psi at 73.4º F.

b. Flexural Strength: 11,000 psi.

c. Compressive Strength: 8,600 psi.

4. Approvals:

a. NEMA TC-2, PVC Type EPC-40 and EPC-80.

b. NEMA TC-3.

c. NEMA TC14 Fiberglass Conduit.

d. UL 5l4fittings.

e. UL 651.

f. ANSI C33.91.

5. Acceptable:

a. Any meeting listing and approval.

H. SURFACE RACEWAY:

1. Drawing & Spec Reference: #SR*, where “#” denotes number of chambers, “*” denotes cross sectional area of each chamber referenced to standard conduit trade size

2. Construction

a. Single chamber, l inch:

1) Drawing and reference designation: 1SR-1

2) Minimum fill capacity shall be equivalent to that of a 3/4 inch trade size conduit.

b. Dual chamber, l inch:

1) Drawing and reference designation: 2SR-2

2) Minimum fill capacity shall be equivalent to that of a 3/4 inch trade size conduit.

c. Three chamber, 3/4 inch:

1) Drawing and reference designation: 3SR-75

2) Minimum fill capacity of each chamber shall be equivalent to that of a 3/4 inch trade size conduit.

d. Three chamber, 2.5 inch:

1) Drawing and reference designation: 3SR2.5

2) Minimum fill capacity of each chamber shall be equivalent to that of a 21/2 inch trade size conduit.

e. Raceway base shall be securely screwed to wall per manufacturer's recommendations.

f. Color per Owner's Representative. In existing construction, to match surrounding surface(s) to which surface raceway will be applied.

g. Three chamber surface raceway shall have three adjacent chambers separated by removable horizontal dividers. System and installation shall not compromise separation of services.

h. Trade connections, device boxes and mounting systems shall not reduce fill capacity, except where specifically scheduled.

i. System shall accommodate connection to trade standard boxes and fittings through accessory boxes and transition pieces

j. Keyed cover plate shall require tool for removal.

3. Functions/Features:

a. Device plates available to meet requirements scheduled on communication drawings.

b. Available in-line track connector options shall include the following minimum:

1) External Elbow

2) Flat Elbow

3) Internal Elbow

4) End Cap

5) Splice Cover

6) Tee Cover

4. Approvals:

a. Plastic or aluminum meeting UL 94-VO flammability rating.

b. Multi-chamber surface raceway shall conform to NEC 352B for simultaneous power and telecommunications use.

I. Surface Raceway for Fiber Optic Cable Protection:

1. Drawing & Spec Reference: FOSR

2. Construction:

a. Plastic, single chamber, with integral minimum 6” bend radius protection at right angles, with hinged cover.

b. Bright Orange finish, with labels applied 5’ o.c. reading “Caution: Optical Fiber”.

c. Trade connections, device boxes and mounting systems shall not reduce available fill capacity, except where specifically scheduled.

d. In-line track connector options shall include the following at minimum:

1) External Elbow

2) Flat Elbow

3) Internal Elbow

4) End Cap

5) Splice Cover

6) Tee Cover

e. Support options to include brackets and angles as necessary to securely support raceway in both lateral and vertical directions.

3. Acceptable, subject to the above:

a. ADC Telecommunications Fiber Guide Fiber Management System, FG5-M* * *-* Series with FGSH *** - * Support hardware (where **"*"** denotes model numbers within a product series).

b. Or equal by Panduit.

J. INNERDUCT, MULTI-CHAMBER:

1. Drawing & Spec Reference: #ID*, Innerduct **("#"** denotes number of chambers, **"*"** denotes cross sectional area of each chamber referenced to standard conduit trade size).

2. Construction:

a. Multi-Chamber Innerduct shall be installed within an outer diameter CRSC or PVC Conduit per manufacturer's recommendation, and as described elsewhere herein.

b. Shall provide independent interior chambers each with a capacity equal to a trade size conduit referenced above.

3. Approvals:

a. ASTM D2239 (1985) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

4. Acceptable, subject to the above:

a. Aeroquip FODuct System (800) 445-2192: (Design Basis) Provide in combinations to meet scheduled requirement.

1) 31D1 - Provide one (1) FoDuct PE5OO4 3 chamber innerduct in one-half of a 4" diameter PVC conduit.

2) 21D1.25 - Provide one (1) FODUCT PESOO7 2 chamber innerduct in one-half of a 4" diameter PVC conduit.

b. North Supply Multi-Guard Multi-Cell Conduit.

c. Or equal by Tamaqua.

5. Acceptable - Independent InnerDuct runs in overall PVC conduit - Multiple runs of single chamber inner duct may be provided in lieu of single, multiple chamber innerduct provided above. Contractor bears burden of selected innerduct quantity to provide an exact match of cross-sectional area of each chamber of multi-chamber assembly and to re-size overall PVC conduit to accommodate this use.

a. Carlon.

b. Or equal.

6. For direct burial or boring, acceptable, subject to the above:

   a. Aeroquip FoDuct Direct Bury

   b. Or equal

K. INNERDUCT, UV RATED

1. Drawing Reference: ID, UV Rated*, where "*" denotes cross sectional area of each chamber referenced to standard conduit trade size).

2. Approvals:

   a. ASTM D2239 (1985) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

3. Construction.

   a. Listed for UV exposure.

4. Acceptable:

   a. Tamaqua Plus II Series Telecom Duct.

   b. Allwire Black AllDuct.

L. FLOOR DUCT

1. Drawing & Spec Reference: FD*, where **"*"** denotes nominal internal width of floor duct to the nearest inch, or by scheduled line type. Where no size given, provide as for FD3.

2. Construction:

   a. Floor duct shall be constructed of steel, rectangular cross-section.

   b. Dimensions:

      1) FD3: 3-1/8" wide x l-¼" high.
      2) FD6: 6-1/2"wide x l-1/2"high.

3. Provide complete system, including:

   a. Duct.

   b. Duct Supports.

   c. Duct to Conduit Adaptors.

   d. In-floor inserts for outlets.

   e. Junction Boxes.

f. Elbows.

g. Expansion Joints.

4. Acceptable:

a. FD3 - Walkerduct No. 2 Duct System

b. FD6 - Walkerduct No. 4 Duct System.

M. Rigid Communications Pole

1. Drawing Reference: RCP

2. Construction:

a. At least a two chamber assembly, suitable for simultaneous routing of power and communications circuits.

b. Aluminum or Steel, At least .070 thick.

c. Smooth Corners - sharp edges not permitted.

d. UL Listed as a “Power Pole”

e. Prefabricated knockouts for communications receptacles.

f. At least 10’-5” tall.

g. At least 4 square inches internal cross-sectional area.

h. Fitting system to rigidly attach to suspended ceiling, framed ceiling (gyp) and floor. Use of Velcro or similar non-rigid attachments at these locations in lieu of mechanical fasteners will not be accepted. Provide angle brackets to make support rigid and appropriate to educational facility use. Provide supplemental means of support where ceiling is higher than supplied pole height.

i. Provide manufacturer’s system of data receptacles to satisfy scheduled requirements. Refer to I7120 for performance requirements of receptacles.

3. Acceptable - Provide complete system including support hardware, plates and receptacles:

a. Hubbell Aluminum Communications Pole - PPXO Putty Finish

b. Hubbell Steel Communications Pole - PP1, PPI 2 or PPI S as applies.

c. Equal by Walker

d. Equal by Wiremold

e. Or equal.

2.03 FITTINGS

A. GENERAL

1. UL 514.

2. Listed in UL Electrical Construction Materials List.

3. Ferrous fittings shall be cadmium or zinc-coated in accordance with UL 514B.

B. FITTING TYPES

1. Condulets:

a. Not acceptable in communications raceway except at speaker level audio, clock and dc control lines.

b. Refer to requirements elsewhere herein regarding conduit swept radius requirements.

c. Crouse-Hinds “Form 8” or equal.

2. Flex Conduit Fittings:

a. Hot dipped or mechanically galvanized squeeze type, clamp type or water-tight type with gland nut where required with insulated throats.

b. Set screw type unacceptable.

3. EMT Fittings:

a. Material to match conduit.

b. Compression type - set screw fittings unacceptable.

c. At wet locations per NEC, raintight, zinc plated steel gland compression type.

d. Box connector to provide insulated throat, l05ºC rated plastic bushing or shall be self-bushed.

e. Acceptable:

1) Bridgeport

2) Midwest

3) Raco

4) Steel City

4. RSC and IMC Coupling and Unions:

a. Locknuts: Steel or malleable iron

b. Bushings: Threaded type, malleable iron, 105ºC rated plastic insulated throat. l05ºC Plastic bushings acceptable at l inch and smaller.

c. Split couplings are not acceptable.

d. Acceptable:

1) Meyers watertight hubs.

2) Watertight locknuts by Midwest or T & B, with O.Z. type B bushings.

3) 4” and smaller - Threaded type.

5. Rigid Nonmetallic Conduit

a. Approvals:

1) NEMA TC3.

2) UL 5l4B.

3) UL 65l.

b. Acceptable:

1) Any meeting approvals.

6. Chase Nipple with Insulators, Steel Locknuts and Insulated Bushings - Thomas & Betts Company or equal.

7. Reducing Bushings, Condulet Gaskets and Condulet Covers -Crouse-Hinds or equal.

8. Thread less Metallic Insulated Bushings for EMT, EMT Straps, Rigid Steel Conduit Straps and Rigid Steel Conduit Couplings: EFCOR or equal.

9. Spare PVC raceway plugs: Underground Products, or equal,

2.04 BOXES AND ENCLOSURES

A. JUNCTION AND DEVICE BOXES

1. Drawing References J, or as scheduled on CSO.l

2. Construction:

a. Concealed/Flush Mounted:

1) One or two piece welded knockout boxes.

2) UL 514A, cadmium or zinc-coated 1.25 oz/sq. ft., if ferrous metal.

3) Pressed sheet steel, for indoor locations.

4) UL 514C approved if non-metallic.

5) At hollow masonry, tile walls and plaster walls, provide with device rings as required.

b. Surface mounted:

1) Exterior - Conform to the Junction and/or Pull Box construction scheduled on the Plans. Where construction not otherwise scheduled or noted on the plans, conform to the following:

a) Cast iron or aluminum with threaded hubs and mounting lugs.

b) Gasketed cover with spring lid.

c. Concrete floor embedded:

1) Cast iron concrete pour boxes with screwed brass cover, unless otherwise noted.

d. Cadmium plated screw cover attachment at least 6” on center.

e. If size not otherwise noted, at least 4S (4” square) by 2-1/8” deep, or Code minimum size, whichever is larger.

f. Provide complete with approved type of connectors and required accessories, including attachment lugs or hangers. Provide raised device covers as required to accept scheduled device.

3. Approvals.

a. UL 5l4A

4. Acceptable:

a. Interior:

1) Steel City.

2) Any meeting criteria.

b. Exterior, exposed with cover of same construction.

1) Appleton

2) Pyle-National

c. Other:

1) Any meeting approvals and requirements.

B. TERMINAL CABINETS:

1. Drawing Reference: As Scheduled.

2. Construction:

a. Zinc Coated Sheet Steel.

b. Interior dimensions not less than those scheduled.

c. Trim fitted with hinged door and flush catch.

d. Door face to be not less than 95% of panel interior dimensions.

e. Provide with 3/4” ply backboard.

1) Interior:

a) NEMA l, unless otherwise noted. Refer to plans and schedules.

2) Exterior:

a) NEMA Rating - As Scheduled, not less than NEMA 3R.

f. Acceptable:

1) Interior:

a) Any meeting listing and criteria.

2) Exterior - As scheduled.

a) Henessey.

b) Hoffman.

c) Rittal.

C.CABLE TERMINALS, OUTSIDE PLANT:

1. Pedestal-Type Cable-Terminals:

a. Suitable for use with buried cable distribution systems.

1) Corrosion-resistant aluminum alloy, galvanized steel, or fiberglass material, in an enamel finish.

2) Shall allow free air circulation, shall prevent rain, snow or dust from entering and damaging the enclosed cable and splices.

3) Locking terminal cover

4) Base shall be stake-mounted or stand-alone.

b. Acceptable:

1) Anixter

2) AT&T

3) Or equal.

2.05 SUPPORTING DEVICES

C. Electrical Supports:

1. Construction:

a. l-5/8” square galvanized channel formed from U.S.S.G No. 12 or 0.109 inch cold formed steel.

b. 10 foot sections.

2. All supporting materials by same manufacturer.

3. Acceptable:

a. Kindorf.

b. Unistrut.

c. Superstrut.

D. Threaded rods, couplings, screws and nuts:

1. Electrolytically coated with zinc, 2 oz. zinc per square foot of surface, ASTM Al23 or Al53.

E. Miscellaneous Parts

1. Hot dipped galvanized after fabrication; after cutting, de-burring and hole drilling. Coated with zinc, 2 oz. zinc per square foot of surface, ASTM Al 23 or Al 53.

F. Paint/Tape for Touch-up:

1. Zinc: CRC “Zinc-It”, Glyptal, Enterprise Galvanizing **“**Galambra”

2. At CRSC, 20-mil 3M brand #51 tape.

3. PVC: PVC paste or equal.

2.06 UNDERGROUND STRUCTURES

A. Precast Handholes & Vaults:

1. Drawing Reference: CS*, where ***** denotes site sequential numbering.

2. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and handholes.

3. Construction:

   a. General:

      1) Concrete for precast work shall have an ultimate 28-day compressive strength of not less than 4000 psi. Castings shall be free from warp and blow holes that may impair strength or appearance.

      2) Structures shall be precast to the design and details indicated, precast monolithically and places as a unit, or structures may be assembled in sections, designed and produced by the manufacturer in accordance with the requirements specified.

      3) Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

   b. Structure top and wall shall be of a uniform thickness of not less than 4 inches except at knockouts.

   c. Thin-walled knock-out panels designed for future duct bank entrances are permitted.

   d. Provide extension rings as-required to extend from finished grade to communications utilities.

   e. Quantity, size and location of duct bank entrance windows shall be as directed and cast completely open by the precaster.

   f. Size of windows shall exceed the nominal duct bank envelope dimensions by at least l2 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment.

   g. Sides of precast windows shall be a minimum of 4 inches from the inside surface of adjacent walls, floors, or ceilings.

   h. Form of the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope.

   i. Provide welded wire-fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes.

   j. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings.

   k. The minimum concrete cover for reinforcing steel shall be 2 inches.

l. Provide drain sumps for precast structures a minimum of l2 inches in diameter and 4 inches deep.

4. Joints:

a. Provide tongue-and-groove or shiplap joints on mating edges of precast components.

b. Design joints to firmly interlock adjoining components and to provide waterproof junctions, and adequate shear transfer.

c. Seal joints watertight using preformed plastic strip conforming to AASHTO Ml98, Type B.

d. Install sealing material in strict accordance with the sealant manufacturer's printed instructions.

e. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

5. Metal Frames and Covers

a. Steel.

b. Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice.

c. Steel covers shall be rolled steel floor plate having an approved anti-slip surface.

6. Pulling-In-Irons

a. Steel bars bent in the form indicated and cast in the walls and floors.

b. Install a pulling-in iron in the wall opposite each duct line entrance at walls, not less than 6 inches above or below, and opposite the conduits entering the manhole.

c. Pulling-in irons shall project into the manhole approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.

7. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

8. Precast Handholes Installation

a. Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted granular fill, 3/4-inch to l-inch size, extending l2 inches beyond the handhole on each side.

b. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

9. Field Painting

a. Steel frames not buried in masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process.

b. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means.

c. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with one coat of primer and one coat of synthetic exterior gloss enamel.

10. Acceptable Manufactures:

a. Brooks Products, Inc. (818) 443-3017, as scheduled.

b. Equal by Christy Concrete Products (800) 486-7070

B.MISCELLANEOUS UNDERGROUND PRODUCTS

1. CONCRETE:

a. Concrete work for communications systems construction shall be 3000 psi minimum ultimate 28-day compressive strength with 1-inch maximum aggregate conforming to the requirements of Division 3 for similar work.

2. Cable Warning Tape:

a. Cable warning tape shall be

1) 3 inches wide minimum,

2) 5 mil plastic,

3) Metallic backing at least 10 foot o.c.

4) l mil metallic foil core.

5) Orange in color

6) Suitable for buried applications.

7) Continuously imprinted with the words “WARNING – COMMUNICATIONS CABLE BELOW” or similar at not more than 48-inch intervals.

3. Cable Warning Sign: Cable warning sign shall consist of one stake mounted warning sign. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer’s instructions.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS:

A. Refer to the Code of Record and the manufacturer's instructions and conform.

3.02 CONDUIT APPLICATION:

A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:

1. Exterior, Exposed:

a. Type RSC for applications up to 8 feet AFF or to first pull box, whichever are first, applications subject to physical abuse or for applications greater than 4" diameter.

2. Interior, Exposed, Dry, Wet and Damp Locations:

a. Type RSC.

b. At interior dry locations over 8 feet above finished floor, EMT acceptable.

3. Interior, concealed, dry locations:

a. RSC, or

b. EMT up to 4"

4. Interior, concealed, damp locations, including in masonry walls.

a. RSC

5. Embedded in Concrete

a. RSC or rigid non-metallic conduit.

b. PVC Type DB-120.

6. Underground

a. CRSC

b. PVC

3.03 CONDUIT INSTALLATION, GENERAL

A. Conduit runs are shown schematically. Install concealed unless specifically noted otherwise. Supports pull boxes, junction boxes and similar generally not indicated. Provide where designated.

B. All conductors shall be installed in raceways and concealed in finished areas or areas exposed to public view. All other raceways shall be exposed unless otherwise noted.

C. Install exposed conduit and raceway parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours. Level and square conduit and raceway runs.

D. Raceway runs shall be mechanically and electrically continuous between all each equipment rack and utility demarcation point, receptacle and/or surface raceway strip, as applies.

1. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box, or outlet by means of a locknut on the outside and a bushing on the inside or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter.

E. Bends.

1. Raceways for Sound System, Telephone System, LAN, and Video System cables shall be designed for the installation of Fiber Optic cable.

2. All bends or elbows shall have a minimum radius as follows:

Conduit size	Min. Radius (Inches)
¾”	12
1”	12
1-¼”	18
2”	24
2-½”	24
3”	30
3-½”	30
4”	30
5”	36
6”	42

3. Use factory ells at conduit bends 1-1/4” and larger. Alternative method: Use of a precision conduit bending machine equivalent to Greenlee ‘One Shot’ or ‘Smart bender’.

4. Boxes where the cable changes direction shall be large enough to allow cables in the box to have a 12” minimum radius.

5. Make bends and offsets so the inside diameter is not effectively reduced. Make bends in parallel or banked runs from the same center line so that the bends are parallel.

6. Alternative method: Contractor possessing a conduit bending machine equivalent to Greenlee 'One Shot' or 'Smart bender' may substitute field fabricated ells for factory fabricated ells.

F. Install at least one (1) 1/8", 200 pound strength nylon pull wire in all empty raceways.

G. Raceways crossing building expansion joints or in straight runs exceeding 100 feet shall be provided with UL listed expansion fittings.

H. Install conduit seals and drains to prevent accumulated moisture in conduits from entering Communications System enclosures.

I. Do not install conduit in concrete slabs unless specifically directed by Owner's Representative. Embedded conduits in concrete slab walls, and columns shall be installed in center third between upper and lower layers of reinforcing steel as directed by the Structural Engineer. Space conduits 8" on center except at cabinet locations where slab thickness shall be increased as directed by the Owner's Representative.

J. All conduits to be kept 12" away from steam or hot water lines. Install horizontal conduit and raceway runs below water and steam piping.

K. Provide rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings and walls.

L. Conduit dropping down to equipment shall be as straight as possible without any offsets.

M. Conduit installed on any equipment shall be run symmetrical with the equipment and in such a manner as to

1. Not to be exposed to damage,

2. Not interfere with access to components of the equipment that will interfere with maintenance operation or, in a manner that the Owner deems detrimental to his operation.

3. Whenever an installation such as that listed occurs, the Contractor shall make all necessary changes at no cost to the Owner.

N. All cut ends of conduit, scratches, tool marks, etc. on any metallic raceway installed in the ground or on the exterior of the building shall be treated with two coats of specified Touch Up Paint/Tape.

O. All raceways stubbing up into equipment or racks shall be sealed. Raceways with conductors shall be plugged with duct-seal. Spare raceways shall be capped. Prevent foreign matter from entering conduit and raceway; use temporary closure protection. Replace conduits containing concrete, varnish or other foreign material.

P. Complete installation of conduit and raceway runs before starting installation of cables / wires within conduit and raceway.

Q. Use specified conduit and raceway fittings that are of types compatible with the associated conduit and raceway and suitable for the use and location. Join and terminate conduit and raceway with fittings designed and approved for the purpose of the conduit and raceway system and make up tight.

R. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed.

S. Horizontal conduit or EMT runs, where required and permitted, shall be installed as close to ceiling or ceiling beams as practical.

T. Conduit and EMT connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes or radiator branches.

U. Conduit and EMT shall not be run through beams, purlins or columns except where permission is granted by Owner's Representative / Owner, in writing.

V. Bond installed metallic raceway in accordance with the requirements of the NEC and/or CEC, as applies.

3.04 CONDUIT INSTALLATION, EXPOSED OUTSIDE PLANT:

A. All raceways penetrating an exterior building wall shall be sealed. Provide NEMA 3R or better box at point of building entry. It is the intent that these raceways (with or without conductors) shall be sealed to prevent moisture and vermin from entering into the equipment and/or that there is a means to drain the raceways.

B. Exterior wall penetrations to by cored for masonry walls and hole sawed for stucco or wood. Holes to be sleeved with appropriate fittings as provided for herein. Pack opening around penetration with batt insulation and caulk watertight as directed by Owner's Representative. Provide escutcheon plate where exposed to public view.

C. At exposed, roof top raceway placement, secure direction from the Owner's Representative as to Project procedures for such installation.

1. Flash and counter flash at roof penetrations. Refer to plans for details.

2. At minimum, place conduit on exterior grade pressure treated fir 2"x 6" wood blocks, at least 2.5 times the width of the conduit group attached or 12", whichever is greater. Secure with pipes to clamping per schedules herein or as directed by Owner's Representative. Refer to plans for details.

3. Do not attach or penetrate the roof membrane unless specifically directed by Owner's Representative.

3.05 UNDERGROUND CONSTRUCTION

A. Use CRSC in soil or underground.

B. Alternately, provide PVC installed as follows:

1. Where innerduct liners are scheduled, terminate and join conduit with CRSC elbows. At exposed building exterior transitions to above ground outside plant, provide CRSC to transition out of soil to l5" above grade minimum. Provide RSC riser to complete riser to a height 8 feet above grade or to first pull box, whichever comes first.

2. Install PVC conduit in sand or fine earth envelope of at least 3" on all sides inside foundation line.

3. Underground PVC runs outside foundation line shall have one length of CRSC (or Schedule 80 where innerduct is not scheduled) centered at foundation line through foundation wall.

C. Duct and Conduit Placement.

1. Duct lines shall have a continuous slope downward toward underground structures and away from buildings with a minimum pitch of 3 inches in l00 feet.

2. Except at conduit risers, accomplish changes in direction of runs exceeding a total of l0 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.

3. Excavate trenches along straight lines from structure to structure before ducts are laid or structure constructed so the elevation can be adjusted, if necessary, to avoid unseen obstruction.

D. Duct Bank.

1. Terminate conduits in end-bells where duct lines enter underground structures.

2. Stagger conduit joints by rows and layers to strengthen the duct bank.

3. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers and top spacers to provide a completely enclosed and locked-in duct bank. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per l 0 feet of duct bank.

4. Before pouring concrete or backfilling, as applies, anchor duct bank assemblies to prevent the assemblies from floating. Anchoring shall be done by driving reinforcing rods adjacent to every other duct spacer assembly and attaching the rod to the spacer assembly.

5. As each section of a duct line is completed from structure to structure, for conduit sizes 3 inches and larger draw a flexible testing mandrel approximately l2 inches long with a diameter less than the diameter of the conduit through a conduit. After which, draw a stiff bristle brush having the same diameter of the conduit through the conduit, until conduit is clear of particles of earth, sand, and gravel; then immediately install end plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through the conduit, until conduit is clear of particles of earth, sand, and gravel; then immediately install end plugs.

E. Unless otherwise noted, exterior communications conduit runs shall be buried a minimum of 24" below finished grade or as required to conform to local utility requirements. Where new trenching is required, backfill and compaction requirements shall be as defined in other parts of these specifications. Unless otherwise noted, individual runs do not require concrete encasement.

F. Where concrete encasement indicated, construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Ducts shall not be smaller than shown. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 inches, except separate light and power conduits from communications conduits by a minimum concrete thickness of 4 inches. The top of the concrete encasement shall not be less than l8 inches below grade except that under roads and pavement concrete be a minimum of 24 inches below grade.

G. Where conduit runs under existing roads, cut and patch the patch the pavement as indicated.

H. Conduit Plugs and Pull Rope. New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

I. Partially Completed Duct Banks. During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, sand and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately l foot apart. Restrain reinforcing assembly from moving during concrete pouring.

J. Connections to New Handholes. Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

K. Connections to Existing Manholes. For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

L. Mark locations of future provision underground raceways by precast reinforced concrete pullbox set flush in ground with stamp brass disk identification plate tied to conduit end with “Ty-Wrap”, “Quick-Wrap” or equal.

M. In existing facilities underground construction, the Contractor shall promptly repair any indicated utility lines or systems damaged by Contractor operations. Damage to lines or systems not indicated, which are caused by Contractor operations, shall be brought to the immediate attention of the Owner’s Representative. If the Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with “indicated” status in determining liability for damages. In any event, the Contractor shall immediately notify the Owner’s Representative of any such damage.

N. At twelve inches below grade, place specified warning tape continuously.

3.06 INNERDUCT PLACEMENT MANUFACTURED MULTI-CHAMBER

A. Conform to Aeroquip Publication “Practice for the Use of FODuct Multi-Channel Ductliner”.

B. Provide chamfered transitions between differing inside diameters of 3” and 4” conduits.

3.07 EXISTING RACEWAY PREPARATION

A. Where existing raceway is indicated for re-use, prepare as follows:

1. Remove existing Wires and Cables (if any).

2. Run a mandrel 1/2” smaller than the inside diameter of the duct through the duct receiving new wires and cables.

3. If the specified size mandrel will not pass through the existing duct, start with a smaller size mandrel and increase mandrel size until the specified sized mandrel will pass.

4. Run a wire brush and clean rag with an outside diameter 1/8” larger than the inside of the duct through the duct receiving new wires and cables.

5. Repeat above until duct is clean and materials detrimental to the wire and cables to be installed no longer exit duct with the clean rag.

3.08 MOUNTING AND INSTALLATION - BOXES AND ENCLOSURES

A. Provide backboxes at all communications systems devices. Installation of device plates directly to wall surface without use of a backbox, unless specifically directed on plans, is unacceptable.

B. The distance between pull boxes shall not exceed l50 feet or more than two (2) 90º bends.

C. Align boxes plumb with floor and surrounding construction. At door frames, locate 4” from frame. Verify placement with Owner’s Representative the details to ensure that box clears all trim, etc.

D. No back to back outlet boxes shall be permitted.

1. In non-fire or sound rated walls separate boxes on opposite walls by a stud.

2. At fire-rated or sound rated walls, separate boxes on opposite walls by 24” minimum.

E. Support and fasten boxes securely. At stud walls use rigid bar hangers, attached to hanger with stud and nut.

F. At existing locations, provide cutting, patching and finishing as required to maintain or restore finishes so that resulting installation is integrated into the Owner’s Representative decor of the particular location.

G. Mounting Height: the mounting height of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate.

H. Mount outlet boxes with the long axis vertical. Three or more gang boxes shall be mounted with the long axis horizontal.

I. Install wiring jacks and outlet devices only in boxes, which are, clean; free from excess building materials, dirt, and debris.

J. Install wiring jacks and outlet devices after wiring work is complete.

3.09 SUPPORT

A. All raceways installed in exposed dry locations shall be grouped in a like arrangement and supported by means of approved wall brackets or trapeze hangers. Fasten all hangers from the building structural system.

B. Provide supports and mounting attachments per industry standard intervals, not to exceed the following.

Raceway Size (inches)	No. of Cables in run	Location	Support Spacing (feet)	
			RSC	EMT
Horizontal Runs				
½, ¾	1-2	Flat Ceiling Wall Runs	5	5
½, ¾	1-2	Where access limited to building structure	7	7
½, ¾	3≥	Any location	7	7
1≥	1-2	Flat ceiling or wall	6	6
1≥	1-2	Where access limited to building structure	10	10
1≥	3≥	Any locations	10	10
Any	Any	Concealed	10	10
Vertical Runs				
½, ¾	Any	Exposed	7	7
1, 1-¼	Any	Exposed	8	8
1-½	Any	Exposed	10	10

C. Install no more than one coupling or device between supports.

D. Cable Tray:

1. Install in conformance with NEMA VE I.

2. Anchor per California Electrical Code Part 2, Table 23P.

E. The Owner, Owner's Representative or the Engineer reserves the right to request additional supports where in his sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.10 PENETRATIONS

A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.

B. Install UL listed fire-stop whenever a raceway penetrates a firewall in conformance with UBC Section 4304 and CEC 300-21. At cable tray penetrations, provide fire stop per CBC 4308.

C. All communications systems conduit openings in walls and floors are the responsibility of this Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set, maybe core drilled.

D. Refer additionally to Outside Plant paragraphs herein.

3.11 SURFACE RACEWAY

A. Install complete raceway system as shown on drawings, including track, cover plate, device boxes and end caps.

B. Communication devices and plates are as scheduled on the drawings and are furnished as the work of Division I7.

C. Attachment of track to wall to be by mechanical fasteners applied to building structure per most restrictive of either manufacturer's directions and/or Code.

D. Corners and joints to be cut neatly and finished using connector components of specified system. Where components are not available using specified system, to meet requirements of drawings, provide cleanly mitered joints, EMT and/or surface backboxes specified elsewhere herein.

E. Remove sharp corners and edges prior to installation of cable.

F. Coordinate installation of communication wiring with work of Division I7.

3.12 PENETRATIONS

A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.

B. Install UL listed fire-stop whenever a raceway penetrates a firewall in conformance with UBC Section 4304 and CEC 300-21. At cable tray penetrations, provide fire stop per CBC 4308.

C. All communications systems conduit openings in walls and floors are the responsibility of this Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set, maybe core drilled.

D. Refer additionally to Outside Plant paragraphs herein.

3.13 SURFACE RACEWAY

A. Install complete raceway system as shown on drawings, including track, cover plate, device boxes and end caps.

B. Communication devices and plates are as scheduled on the drawings and are furnished as the work of Division I7.

C. Attachment of track to wall to be by mechanical fasteners applied to building structure per most restrictive of either manufacturer's directions and/or Code.

D. Corners and joints to be cut neatly and finished using connector components of specified system. Where components are not available using specified system, to meet requirements of drawings, provide cleanly mitered joints, EMT and/or surface backboxes specified elsewhere herein.

E. Remove sharp corners and edges prior to installation of cable.

F. Coordinate installation of communication wiring with work of Division I7.

G. Upon successful completion of testing and acceptance of systems by Division I7, install cover on track.

END OF SECTION

SECTION 26 00 09
FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and drawings for related work required to be included as work under Division26.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONALREQUIREMENTS)

A. Submittal Documentation

1. Submit State Fire Marshal, AHJ and UL Listing numbers for each item of fire alarm system equipment and components.

2. Submit Manufacturer’s standard catalog data for each fire alarm components. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of item. The data sheet shall completely describe the proposed item including listing numbers. Where modification to the equipment is necessary to meet the operational requirements of the Contract Documents, the brochure shall include complete mechanical and electrical shop drawings detailing the modification. The brochure shall include a listing of the outlet rough- in needed for every device and equipment item. The applicable symbol, which illustrates that rough-in item on the drawing plans, shall be shown in the submittal opposite the description of the rough-in to facilitate locating the data by field personnel. Submit elevation and dimensional information.

1.03 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

A. General

1. The equipment shall be listed, labeled, and approved for the application shown in the Contract Documents, as fire alarm equipment complying with the most recent versions of the install requirements of the following Applicable Standards. The following standards shall become requirements of and are included in the Contract Documents:

2. Factory Mutual Approval Guide (FMAG)

3. United States Department of Justice Rules for Building Accessibility by the Handicap (ADA).

4. The Equipment Manufacturer guidelines.

5. State Building Codes, local building codes and Authorities Having Jurisdiction(AHJ).

6. National Electrical Contractors' Association: NECA-305, Recommended Practice for Installing Fire Alarm Systems.

B. National Fire Projection Agency(NFPA)

1. NFPA 72, National Fire Alarm Code.

2. NFPA 90A, installation of air conditioning and ventilating systems.

3. NFPA 70, National Electrical Code (N.E.C.), and N.E.C. Article760.

4. NFPA 101, Life Safety Code.

C. Underwriters Laboratory(UL)

1. UL 864, Control Units for Fire Protective Signaling Systems.

2. UL 268, Smoke Detectors for Fire Protective Signaling Systems.

3. UL 268A, Smoke Detectors for Duct Applications.

4. UL 521, Heat Detectors for Fire Protective Signaling Systems.

5. UL 228, Door Closers-Holders for Fire Protective Signaling Systems.

6. UL 464, Audible Signaling Applications.

7. UL 1638, Visual Signaling Appliances.

8. UL 38, Manually Actuated Signaling Boxes.

9. UL 346, Waterflow Indicated for Fire Protective Signaling Systems.

10. UL 1481, Power supplies for Fire Protective Signaling Systems.

11. Note: Provide the complete, installed and tested fire alarm system with an Underwriters Laboratory Field Certification from an independent third party alarm service company, designated and authorized by UL for fire alarm certification.

D. The California State Fire Marshal, California Building Code (CBC) and California Fire Code(CFC)

1. 2022 Building Standards Administrative Code, Part 1, Title 24C.C.R.

2. 2022 California Building Code (CBC), Part 2, Title 24C.C.R.

3. 2022 California Electrical Code (CEC), Part 3, Title 24C.C.R.

4. 2022 California Mechanical Code (CMC), Part 4, Title 24C.C.R.

5. 2022 California Plumbing Code (CPC), Part 5, Title 24C.C.R.

6. 2022 California Fire Code (CFC), Part 9, Title 24,C.C.R.

7. 2022 California Referenced Standards Code, Part 12, Title 24,C.C.R.

8. Title 19, C.C.R., Public Safety, State Fire Marshal Regulations.

E. Installation and Testing Completion

1. Written certification by the Fire Alarm Equipment Manufacturer shall be submitted to the OWNER'S Representative, stating that the proposed system and its component parts are listed and approved by UL, the State Fire Marshal, and/or AHJ.

2. Upon completion of installation, written certification by the CONTRACTOR and Fire Alarm Equipment Manufacturer shall be submitted to the OWNER'S Representative Certifying the installation has been tested, is operational and conforms to the requirements of the Contract Documents, applicable Building Codes and AHJ.

1.04 EQUIPMENTQUALIFICATIONS

A. General

1. As directed by the OWNER, The equipment shall be as manufactured Notifier/Honeywell to match existing equipment on site. No substitutions will be approved.

2. Fire alarm system items described by Manufacturer's part number, shall comply with the performance Specifications published by the Manufacturer's most recent catalog data sheets at the time of bid date and shall become the requirements of the Contract Documents.

3. The fire alarm system installation company shall be an authorized Distributor and Service Provider for the fire alarm system equipment specified in the Contract documents and furnished as part of Contract work. The fire alarm installation company shall be certified and their staff shall be trained for the fire alarm system equipment furnished as part of Contract work. Provide six (6) copies of written documentation from the Fire Alarm System Manufacturer demonstrating compliance in good standing with the "Authorized Distributor," "Service Provider," "certification" and "training "requirements.

4. A Fire Alarm System Technician authorized by the Manufacturer of the fire alarm system shall supervise the CONTRACTORS installation, testing, certification and instruction of OWNERS' Personnel in the operation of the fire alarm system. The Technician shall be experienced with the specific system and licensed in the respective State for Fire Alarm Systems.

5. NICET – National Institute for Certification in Engineering Technology:

a. The CONTRACTOR's fire alarm field installation personnel, shall be NICET (Level-2 or greater) certified in fire alarm systems.

b. Submit documentation showing compliance of NICET current valid certification for key personnel.

PART 2 - PRODUCTS

2.01 GENERAL SYSTEMOPERATION

A. Alarm Conditions

1. Actuation of any manual or automatic alarm initiating device, connected to the fire alarm system shall cause the following automatic functions. The automatic functions and actions shall be selectable by fire alarm system software program control functions and shall comply with the AHJ requirements:

2. Audio and visual alarm evacuation signaling units shall activate continuously. Provide evacuation alarm “coded” signaling and zoning to comply with AHJ.

3. The respective zone alarm annunciator and annunciator displays on the fire alarm control panel, remote annunciator panels, and remote annunciation/monitoring equipment shall be activated.

4. Activate the central alarm system, offsite central station equipment interface and activate telephone/ dialer monitoring lines.

5. Provide and perform any additional functions as specified herein, shown on the drawings/Contract Documents or required by the Fire Marshal, and AHJ.

B. Trouble Conditions

1. Actuation of any status or supervisory trouble condition connected to the fire alarm system shall be monitored and cause the following automatic functions:

a. Activate the respective alarm zone trouble remote annunciator panels and annunciator display on the fire alarm control panel, remote annunciator panels and remote annunciation/monitoring equipment.

b. Sound and audible trouble signal on the fire alarm control panel, remote annunciator panels, and remote annunciation/monitoring equipment.

c. Activate the offsite central station trouble monitoring circuit.

2. Monitor and detect trouble/failure in any fire alarm systems electrical and electronic circuits, displays, operating software, communications devices, operator controls and equipment control devices.

3. Monitor and detect trouble that may prevent proper operation of any fire alarm initiating device/circuit, evacuation alarm device/circuit, communications device /circuit, control device/circuit etc., including breaks and/or shorts in circuits and display a trouble condition.

4. Each 120 volt AC electric power source connected to any fire alarm system component shall be monitored with indication by a "power on" display annunciator. Upon normal source power outage, the system shall activate a power trouble condition display, and indicate a trouble

5. Monitor the standby batteries and, upon a low battery condition or battery charging failure, activate the low battery display and indicate a trouble condition.

6. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection display and indicate a trouble condition.

7. Smoke detector “pre-clean” pre-trouble condition and secondary “dirty-detector” trouble condition activate the respective detection display and indicate a trouble condition.

2.02 EXISTING FIRE ALARM CONTROL PANEL(FACP)

A. Replace existing FACP with Notifier NFS2-640 voice evac FACP to fully interface with the new construction. Reconnect existing fire alarm devices and reprogram system.

2.03 AUTOMATIC ALARM INITIATINGDEVICES

A. General:

1. An electronic digital, network/multiplex, addressable module shall be incorporated into each initiating device. The device shall communicate the alarm condition; the status condition; the trouble condition of each device, with digital electronic unique address codes for each device. The device shall bi-directionally communicate with; be supervised by; and monitored by the fire alarm control panel. Address assignments shall be set electronically and reside at the device location in non-volatile memory. Memory shall be maintained during electric power outage.

2. Devices shall be suitable for use on a Class "A", 4-wire (Class "B", 2- wire) supervised alarm initiating circuit.

3. Screw type terminals with numbered identification shall be provided for each "in-out" connections of the alarm circuit wiring.

4. Surface mount devices on a flush mounted outlet box, unless indicates otherwise on the drawings.

5. Auxiliary double throw spare relay contact shall be provided for activation of remote rated devices 120V-60Hz, AC - 1-amperеminimum.

6. Initiating devices shall be reset and tested from the fire alarm control panel and shall not require local individual resetting or testing.

7. LED mounted on device, with continuous LED illumination and flashing LED illumination shall be used to differentiate between alarm/trouble conditions and normal operations

8. RF noise, lightning protection and transient voltage filtering shall be provided internally in the device.

9. The devices shall operate in ambient air environment as follows: Automatic “drift” compensation of sensitivity shall maintain sensitivity settings by automatically compensating for effects caused by outside environment and dirt contamination sources:

a.	Temperature Centigrade	0 degrees to 49degrees
b.	Humidity	0 to 95 percent non-condensing
c.	Elevation	sea level to 15,000feet

B. Smoke Detector

1. Detectors shall comply with UL standards 268, 167 and 168 (latest revisions) and shall use solid state electronic circuits throughout.

2. The smoke detector shall operate on a total of two (2) circuit wires. Alarm signaling, communication, and detector power shall use the same conductors.

3. Detector sensitivity shall be adjustable at the sensor and from the fire alarm control panel. An automatic circuit shall compensate for detector aging and dirt accumulation; the dirt/aging compensation shall be adjustable by software programming functions from the fire alarm control panel.

4. A fine mesh insect screen shall be provided on all detector openings.

5. The detector shall lock-in on alarm with local reset and fire alarm control panel remote reset. An electromechanical test feature shall provide functional testing of the unit without smoke.

6. Detection sensing methods:

   a. Photo electric type smoke detectors shall employ a light emitting diode (LED) as the detector light source, activated by the presence of combustion smoke products. Failure of the LED shall activate the alarm/trouble light on the detector.

   b. Ionization type smoke detector shall employ the triple chamber, dual chamber ionization principle, activated by the presence of combustion products. The ionization chamber shall be RF shielded.

   c. The detector shall also incorporate a fixed temperature heat detector rated at 135 degrees F. The heat detector shall operate the alarm circuit and alarm/trouble light.

7. Plug-in “twist-lock” detector connection to a fixed mounting/connection detector base.

8. Area protection smoke detector, photo electric or ionization type, and with internal fixed temperature heat detector. Self-contained inside a protective housing/cover. Suitable for open area coverage and for installation on a wall (vertical) locations, or on a ceiling (horizontal) installation locations.

9. Smoke detectors installed in HVAC air plenums, above ceiling or in floor spaces,

shall be listed, and approved for the actual installation location.

C. Fire Detector - Heat

1. Heat detectors shall be dual action electro-thermostatic combination rate of temperature rise and fixed temperature operation. The detector shall automatically compensate for the thermal inertia of the detector.

2. The rate of rise element shall be self-restoring, after activation.

3. The fixed temperature unit shall be set at 135 degrees F (190 degrees F for high temperature areas, i.e. areas over 110 degrees F ambient).

4. Provide a wire guard cover for the detector.

5. Plug-in “twist-lock” detector connection to a fixed mounting/connection detector base.

6. Detectors shall be suitable for wall (vertical) location or ceiling (horizontal) installation location.

2.04 EVACUATION ALARM DEVICES

A. General

1. Evacuation alarm devices shall activate automatically from the control panel. Devices shall operate on a Class "A", 4-wire (Class "B", 2-wire) supervised alarm evacuation circuit. Series wired alarm devices shall not beused.

2. Screw type terminals with numbered identification shall be provided for "in-out" connections of the alarm circuit wiring.

3. Devices shall be installed in a metal box, 3.9-inches deep maximum, flush mounting unless indicated otherwise on the drawings. Provide extension ring to increase the box depth, on the mounting box, if additional depth is required to accommodate the evacuation alarm device. Size as required for the audible alarm indicating device and wiring connections. Provide a trim ring and metal grill cover assembly. Cover assembly shall be a minimum of 0.062 inch thick flat stainless steel or aluminum. Finish color of cover “red” unless selected otherwise by OWNER’S Representative. The word "FIRE" shall appear on the grill, minimum 0.5-inch high letters. The grill shall be screw attached to the box. The grill shall be square/rectangular shape for wall mounted evacuation devices and round for ceiling mounted evacuation alarm devices.

4. A visual alarm indicating device shall be an integral part of the audible alarm box cover assembly, for wall mounted and ceiling mounted devices. Each audible evacuation alarm device shall incorporate an integral visual alarm indicator unless indicated otherwise on the drawings.

5. Alarm initiating devices, audible evacuation alarm device and visual evacuation alarm devices shall each be connected to separate circuits and conductors. Do not connect these devices to the same circuit conductors. The separate audible evacuation circuits shall provide coded or non-coded audible signaling independent of the visual evacuation alarms.

6. The audio sound fire alarm evacuation system shall provide a sound intensity of not less than 20dBa [15dBa] above average ambient sound intensities, and 5dBa [10dBa] above maximum ambient sound intensity occurring for 60 seconds. Ambient sound intensities shall be measured after the OWNER has occupied the building spaces. In no case shall the sound intensity of the evacuation devices be less than 90dBa or greater than 120dBa when measured 10-feet horizontally from the device.

B. Audible Evacuation Alarms

1. Vibrating horns:

a. Vibrating type horns shall be provided where audible devices are shown on the drawings for the following areas: Building egress pathways, exterior of buildings, stairs, corridors, lobbies, reception areas, shops, exercise areas, areas exceeding 300squarefeet, and all other areas not specifically listed or identified.

b. Horn shall be heavy duty electro-magnetic vibrating type. Horns shall have field adjustable sound output level control.

c. Horn shall provide a minimum sound level of 95dB at 10 feet centerline distance, when installed in the field operating conditions shown on the drawings.

2. Mini-horns:

a. Shall be used in rooms smaller than 300 square feet. Mini-horns shall not be used as a substitute where vibrating horns are required.

b. Mini-horn shall be electric-piezo electronic.

c. Mini-horn shall provide a minimum sound level of 87dB/90Dba at ten feet centerline distance, when installed in the field operating conditions shown on the drawings.

C. Visual Evacuation Alarm Indicator

1. Lamp/Strobe internally illuminated projecting lens assembly, with flasher system. Unit shall flash on and off to provide visual indicating of fire alarm.

2. The word "FIRE" shall appear on the lens or lens plate. The lens shall project beyond the face of the cover assembly.

3. All visual evacuation alarm devices with a common evacuation alarm zone shall “flash” in full synchronized unison or in random pattern, software programmable from the fire alarm control panel. The synchronized visual evacuation alarm devices shall not “drift” out of synchronization at any time during operation.

4. The flash rate shall be software programmable from the fire alarm control panel for 1-3 flashes per second, with approximately 0.001 second flash duration.

5. Flash rate independent of audible device coded signal output.

6. Light source, Xenon high intensity flash strobe tube white/clear color, for Fire Alarm.

7. 75 candelas (cd) minimum, 180 candelas maximum flash intensity, at 10 feet distance along the direct line perpendicular axis viewing angle. The “Effective Intensity” of each flash shall not be less than 30 candelas from any viewing angle, but under any condition not less than required by AHJ. The flash intensity shall be “field” adjustable over the specified range.

8. Photosensitive induced epilepsy:

   a. Wherever three (3) or more multiple visual evacuation alarm devices are visible from any single location, the devices shall be adjusted to reduce the risk of inducing photosensitive epilepsy seizure responses in susceptible people, using one or more of the following methods:

      1) Synchronizing the flash rate.

      2) Adjust the flash intensity.

      3) Adjust the physical location of the visual device.

      4) Devices installed closer than 55 feet distance “sight-line” together shall be synchronize flash rate.

PART 3 - EXECUTION

3.01 FIRE ALARM SYSTEMCONFIGURATION

A. Fire Alarm System Survivability

1. The fire alarm system equipment, wiring/cables, alarm initiation, alarm evacuation and zoning shall be configured, supplied and installed so a single point failure and/or fire damage condition does not contribute to the disruption of the operation of the entire fire alarm system. The undamaged portions of the fire alarm system will continue to operate during afire.

2. Separate and isolated routing paths through the building shall be provided for fire alarm circuits to avoid total loss of fire alarm system communications resulting from failure and/or fire damage, for both lateral/horizontal distribution communication paths on each floor and vertical riser communication paths in multi-story building.

3. Quantities and arrangements of components contained in fire alarm equipment shall assure no single individual component failure will cause a failure of the equipment to provide the continued operation of the fire alarm system.

3.02 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. General

1. The inside cover of alarm initiating devices and communicating devices shall be marked with the zone initiating number communications identification address corresponding to the zone number in the respective control panel. Marking shall

be with a felt-tip pen or permanentlabel.

2. The door(s) into the room or closet containing the Fire Alarm Control Panel shall be provided with a sign stating "FIRE ALARM CONTROL PANEL INSIDE". Minimum 1-inch high "block" letters, white letters on a red background. Fasten sign to exterior side of door with a minimum of four (4)screws.

3.03 TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

A. General

1. The entire fire alarm system shall be tested after the installation and software programming is complete.

2. Individually activate each manual initiating station and verify correct alarm operation and control panel response, and remote equipment operation.

3. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.

4. The fire alarm system installation and operation shall be verified by the Manufacturer’s Representative and a written Manufacturer’s verification certificate delivered to the OWNER'S Representative.

5. Individually operate each control function.

6. Test the battery back-up systems by disconnecting the incoming normal power and allowing the alarm system to operate 72 hours on battery power. Sound the alarm system for the specified reserve operation minutes at the end of 72 hours on batterypower.

7. RFAP – Remote Fire Alarm Annunciator Panel, FACP – Fire Alarm Control Panels and REMC – Remote Equipment Monitoring and Control Units: Test and verify each individual device and address connected to the RFAP, FACP and REMC equipment. Document each device type and address, physical location, initiation and supervisory trouble, loss of power, response time and sensitivity.

8. Fire alarm initiating devices: Test and verify each individual device with walk-around initiation, supervisory trouble test, and device missing test. Document each device type and address, physical location; activate/reset response time and sensitivity. Also activate each manual test button and automatic test sequence.

   a. Activate each fire manual pull station and pull station cover with subsequent reset. For "break-glass" type, remove glass rods for test and then reinstall after completed.

   b. Each fire smoke detector, activation test with UL listed aerosol "canned-smoke".

   c. Each fire heat detector activation test with "heat-gun", heat rate-of-rise and temperature set point.

9. Fire alarm evacuation devices: When the fire alarm system evacuation alarms

are initiated, confirm each evacuation device location functions correctly. Document each device type and address, physical location, sound level intensity (audibility and intelligibility) for audible devices in each room with and without devices), visual (direct and indirect) intensity for visual devices, and activate/reset response time:

a. Central Station monitoring notification and response occurs.

B. Documents and Performance

1. Perform all electrical and mechanical tests required by the Equipment Manufacturer's Certification form. Measure and adjust each automatic detection detector to the maximum stable sensitivity setting. Detector tests shall be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. An operational check-out test and report shall be performed. Submit six (6) copies of test report results. The tests and report shall include, but not be limited to:

a. A complete list of equipment installed and wired.

b. Indication that all equipment is properly installed and functions and conforms with these Specifications.

c. Test of each individual zones as applicable.

d. Serial numbers, locations by zone and model number for each installed detector.

e. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.

f. Response time on thermostats and flame detectors (ifused).

g. Technician's name, certificate number and date.

h. The completed manual and automatic monitoring and control system shall be tested to insure that it is operating properly. This test will consist of exposing the installed units to a standard fire test.

C. Acceptance Demonstration

1. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates continuously for a 90-day test period without any unwarranted alarms. In the event an unwarranted alarm(s) occur, the CONTRACTOR shall repair, readjust or replace the defective equipment and detector(s) with new equipment and begin another 90-day test period. The CONTRACTOR shall recheck the equipment and detectors using the fire test after each readjustment or replacement of equipment and/or detectors.

2. Testing verification cycle shall be continuously repeated until the system successfully completes the testing. The test period shall not start until the OWNER has obtained beneficial use of the building areas under tests.

3.04 WIRING (ADDITIONALREQUIREMENTS)

A. General

1. Review the total system point-to-point wiring and cable layout. Provide the correct quantities and types of wires, cables, outlets, and conduits/raceways to ensure the correct operation of the fire alarm system.

2. Final connections, testing, adjusting, and calibration shall be made under the direct supervision of a factory-trained technician of the system supplier.

3. All wiring and cables shall be in conduits/raceways. All conduits/raceways shall be installed and concealed in walls, above ceilings and in floors.

4. All wiring and cables in cabinets shall be neatly formed and laced.

5. Wiring shall be made up onto bolt and nut terminal blocks. Tag all spares. All wire conductors shall terminate on terminal strips with “spade” “eyebolt” type lugs, of adequate size for respective incoming and outgoing conductors. The terminal strips shall be labeled as to their use and wiring diagram shall be placed on/inside the equipment showing connections of all related equipment to these strips.

6. Wiring requirements for shielding certain conductors from other conductors or routing of fire alarm circuits in separate isolated raceways shall be as recommended by the Manufacturer's documentation and AHJ.

7. The fire alarm circuits, location, quantities of raceways, circuit conductors and devices shown on the drawings are schematic. Provide all conduit, raceways, wiring, cables, devices and conductors per Manufacturer’s recommendations and as required by AHJ. Include all material and labor costs in the Contract price for compliance with providing a complete and operable fire alarm system.

8. Wire and cable shall be type and size to insure installed circuit voltage drop and signal loss does not exceed Manufacturer's recommendations, but in no case shall the voltage drop and/or signal loss exceed the values permitted by the AHJ, including allowances for spare capacity/devices.

9. Provide End of the Line (EOL) circuit termination device on each wiring circuit, for the trouble supervisory monitoring of each circuit by the fire alarm system.

10. All fire alarm raceways/conduit shall be installed concealed in public areas. All conductors and cables shall be installed in raceways/conduits.

11. Conductors and Cable Types

a. Conductors, wiring and cables used for fire alarm system circuits shall be Fire Marshal, California State Fire Marshal listed, AHJ and UL labeled and listed for fire alarm system applications. Isolated rated for 600 volts AC60Hz.

b. Raceways/conduits for installation of fire alarm circuits shall be metal for all locations installed above earth/grade. Metal conduits shall be EMT,

RGS or IMC type. FMC and LTFMC conduits shall not be permitted for fire alarm system circuits.

B. Digital Multiplex Network Circuits

1. The conductors for digital, multiplex network and communication circuits shall be twisted insulated pairs, each twisted pair 100-percent metallic shielded, four (4) twisted pair multi- conductor jacketed cable, with a separate 100-percent metallic shield enclosing all conductors under the jacket, #16 AWG copper conductors minimum with a separate internal ground/drain conductor.

2. "Tees" and taps at any junction box location in the communication lines, shall be permitted by the system for connecting additional devices without affecting proper system operation.

C. Conductors for Non Digital Circuit

1. The minimum insulated conductor size for fire alarm non-digital evacuation alarm circuits, initiating circuits and control circuits shall be not less than #14AWG (600 volt THHN/THWN)copper.

2. Conductors for evacuation alarm device circuits shall be insulated (600 volt THHN / THWN) stranded or solid copper conductors, quantity as recommended by Fire Alarm Manufacturer.

3.05 SPECIAL INSTALLATION REQUIREMENTS

A. General

1. Whether or not shown on the fire alarm drawings, the following systems shall be provided as part of the Contract. Provide fire alarm devices and connection of the systems to the fire alarm control panel including all material, labor, and cost in the Contract.

2. Refer to HVAC, Mechanical, Plumbing, Fire Sprinkler and Architectural drawings and Contract documents for the location and quantity of these systems.

B. Area Protection Automatic Smoke Detectors and Heat Detectors

1. Area protection smoke detectors and heat detectors shall be ceiling mounted unless noted otherwise on the drawings. Smoke detectors that are installed before final job site cleanup is complete by all trades shall be cleaned or replaced with new smoke detectors to match original smoke detectors.

2. Provide detector quantities to insure a minimum of one automatic detector for each 600 [900] square feet of area, (and fraction thereof) for each building space where smoke detectors are required by the AHJ. In no case shall detector spacing exceed Manufacturer’s or AHJ maximum recommendations/limits.

3. Provide detector quantities to insure the centerline to centerline spacing of installed detectors does not exceed Manufacturer's and AHJ's requirements in the protected area.

4. Locate area protection detectors a minimum of 48 inches horizontal distance

from any air transfer grill/vent, air intake grill/vent and air discharge grill/vent.

5. Provide connection of automatic initiating devices to the fire alarm multiplex control system with 0.75-inch conduit and digital multiplex communications conductors.

3.06 OUTLET BOXES (ADDITIONALREQUIREMENTS)

A. Device outlet boxes shall be flush mounted unless indicated otherwise on the drawings. Provide extension rings to finish flush with finish surface. Where the drawings indicate surface mounted devices, outlet boxes shall be cast metal with threaded hubs. Where the conduit entrances are not exposed for surface mounted devices, provide flush outlet box behind the device box and omit the conduit hubs on the device box.

B. Size device boxes and outlet boxes per Manufacturer recommendation and as required by building code for wire fill and construction.

C. Outlet boxes shall be listed and approved for fire alarm system use by AHJ and UL.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rod electrodes.

2. Wire.

3. Mechanical connectors.

4. Exothermic connections.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

2. NFPA 99 - Standard for Health Care Facilities.

D. American Society for Testing and Materials (ASTM)

1. B30 - Specification for Copper-Base Alloys in Ingot Form.

2. B187 - Specification for Copper Bus Bar, Rod, and Shapes.

E. Underwriters Laboratories Inc. (UL)

1. 467 - Grounding and Bonding Equipment.

2. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.03 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.

2. Metal building frame.

3. Concrete-encased electrode.

4. Rod electrode.

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms

maximum. 1.05 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding

electrodes. 1.07 QUALITY ASSURANCE

A Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL

labeled. 1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.10 COORDINATION

A Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.01 ROD ELECTRODES

A. Manufacturers:

1. Apache Grounding/Erico Inc.

2. Copperweld, Inc.

3. Erico, Inc..

4. O-Z Gedney Co.

5. Thomas & Betts, Electrical.

B. Product Description:

1. Material: Copper-clad steel.

2. Diameter: ¾ inch (19 mm).

3. Length: 8 feet (2.4 m).

C. Connector: Connector for exothermic welded Connection.

2.02 ACTIVE ELECTRODES

2.03 WIRE

A. Material: Stranded copper.

B. Foundation Electroes: 4/0 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.04 MECHANICAL CONNECTORS

A. Manufacturers:

1. Apache Grounding/Erico Inc.

2. Copperweld, Inc.

3. Erico, Inc.

4. ILSCO Corporation.

5. O-Z Gedney Co.

6. Thomas & Betts, Electrical.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.05 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Apache Grounding/Erico Inc.

2. Cadweld, Erico, Inc.

3. Copperweld, Inc.

4. ILSCO Corporation.

5. O-Z Gedney Co.

6. Thomas & Betts, Electrical.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.02 PREPARATION

A. Remove paint, rust, and surface contaminants at connection points.

3.03 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install additional rod electrodes to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Install 4 AWG bare copper wire in foundation footing.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

H. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

J. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

K. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground resistance testing in accordance with IEEE 142.

D. Perform leakage current tests in accordance with NFPA 99.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Conduit supports.

2. Formed steel channel.

3. Spring steel clips.

4. Equipment bases and supports.

1.02 REFERENCES

A. National Fire Protection Association:

1. CEC – California Electrical Code.

1.03 SUBMITTALS

A. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load

capacity. 1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

PART 2 - PRODUCTS

2.01 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger
rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

2.02 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on

center. 2.03 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

PART 3 - EXECUTION

3.01 PREPARATION

A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.02 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Steel Structural Elements: Provide beam clamps.

2. Concrete Surfaces: Provide expansion anchors.

3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.

4. Solid Masonry Walls: Provide expansion anchors.

5. Sheet Metal: Provide sheet metal screws.

6. Wood Elements: Provide wood screws.

B. Inserts:

1. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

G. Install surface mounted cabinets and panelboards with minimum of four anchors.

H. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.03 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nameplates.

2. Wire markers.

3. Underground Warning Tape.

1.02 SUBMITTALS

A. Product Data:

1. Submit manufacturer’s catalog literature for each product required.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.

B. Letter Size:

1. 1/4 inch high letters for identifying individual equipment and loads.

2. 1/2 inch high letters for identifying grouped equipment and loads.

3. 3/8 inch high letters for identifying panelboards

C. Minimum nameplate thickness: 1/8 inch.

2.02 WIRE MARKERS

A. Description: Split sleeve type wire markers.

B. Legend:

1.Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

3.03 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using screws.

5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

6. Install nameplates for the following:

a. Switchboards.

b. Panelboards.

c. Service Disconnects.

C. Wire Marker Installation: Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

D. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This specification covers single-phase and three-phase general purpose individually mounted dry-type transformers, 600 V maximum, for power and lighting applications. It includes transformers as specified and as indicated on Drawings.

B. 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.

C. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 0526: Grounding and Bonding.
5. Section 26 0519: Low-Voltage Wires (600 Volts AC)
6. Section 26 0533: Raceways and Boxes, Fittings and Supports.
7. Section 26 2600: Power Distribution Units.
8. Division 27: Communications.

D. Codes and Applicable standards: Products and installation shall meet or exceed the latest edition of the following standards.

1. ANSI/IEEE C57.96, Distribution and Power Transformers, Guide for Loading Dry-Type Transformers; Appendix to ANSI C57.12 Standards.
2. Department of Energy, Energy Act of 2005.
3. International Electrical Code adopted by the State of California.
4. ANSI/NEMA 250 Enclosure for Electrical Equipment (1000 Volts Maximum)
5. IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.

6. IEEE C57.110 – IEEE Recommended Practice for establishing liquid-filled and dry-type power and distribution transformer capability when supplying nonsinusoidal load currents.

7. 1100-IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

8. NEMA standard 20, Dry-Type Transformers for General applications.

9. UL 506, Specialty Transformers.

10. UL 1561, Dry-Type General Purpose and Power Transformers.

11. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.

12. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

13. NEMA TP-3, Standard for the Labeling of Distribution Transformer Efficiency.

14. CSA 802.2-00 Minimum Efficiency Values for Dry Type Transformers

15. California Building Code (CBC)

16. Tri-axial shake test results conducted in accordance with AC156 test protocol.

17. NFPA 70 National Electric Code

E. 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 Authorized Representative by the CONTRACTOR.

F. ACRONYMS

ANSI	American National Standards Institute
AOR	Architect of Record
CEC	California Electrical Code
EOR	Engineer of Record
IBC	International Building Code

IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical manufacturers Association

1.02 DESIGN REQUIREMENTS

A. Premium Efficiency transformers with internal losses at 35 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA Standard TP1

B. Load Mix: Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computer without detracting or significant degradation of efficiency.

C. The transformer shall be labeled with a K-9 Rating in accordance with UL 1561 35.21 and 34.2.

D. K-7 rating is not allowed.

E. Construction: Windings shall be continuous wound copper with brazed or welded terminations.

1. Insulation and Varnish Systems: Epoxy Polyester impregnation

2. Terminals, including those for changing taps must be readily accessible by removing a front cover plate.

F. Performance of transformers shall meet or exceed the requirements of applicable codes and standards, the DOE Energy Policy Act of 2005 - Public Law 109-58 and the latest requirements of the California Energy Commission Appliance Efficiency Regulations. In addition; transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimized Energy Performance) and Utility Rebates.

G. Transformers shall be self-cooled type with 220 degrees C. insulation and a maximum temperature rise of 130 degrees C. under continuous full load conditions with an ambient of 40 degrees C.

H. Transformers shall be furnished with four 2.50 percent (two above and two below normal voltage) taps. Windings shall be of fire-resistant type, designed for natural convection cooling through normal air circulation.

I. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, installation, and short circuit stresses.

J. Enclosure cover plates shall be sheet steel, captive bolted to enclosure framework. Enclosure shall provide suitable ventilating openings with rodent-proof screens, NEMA 1 enclosure. Enclosure shall be provided with lifting lugs and jacking

plates as required. Transformers installed outdoors shall be provided with weatherproof NEMA 3R enclosure and weather proof kit.

1. Submit rodent-proof screen sample for OWNER's approval.

K. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, excepting cores and core mounting frames shall be furnished clean, rust-proofed, and provided with a coat of an inert primer.

L. Transformers up to 35 KVA shall not exceed 40 decibels. Transformers 36 KVA or more shall be a minimum of 5 decibels below NEMA standards per unit. Transformers shall be provided with vibration dampers consisting of California Dynamic, Mason Industries, Korfund or equal neoprene mounting pad and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

M. Transformers shall be UL listed.

N. Each transformer to be installed under this section shall be sound tested at the factory. CONTRACTOR shall provide two copies of transformers tests reports for EOR's review.

O. Equipment shown on drawings to scale is approximate only and based upon a general class of equipment specified. The CONTRACTOR shall verify dimensions and clearances prior to commencement of work.

P. Verify points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. Actual dimensions, weights, clearances and installation requirements shall be verified and coordinated by the CONTRACTOR.

Q. Provide transformers with a K rating as indicated on drawings. K-rated transformers shall be type NL-UL or NLP-UL as indicated on drawings and be equipped with the following features:

1. Electrostatic shield.

2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.

3. Double-size neutral terminal.

4. Additional coil capacity to compensate for higher non-linear load loss.

5. Heavy-gage ventilated indoor enclosures (provide weather shields where installed indoors).

6. K-rated transformers shall meet other requirements of this section.

1.03 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include make, catalog number, dimensions, weight, KVA Rating, Percent Impedance, finish, type, insulation class, design temperature, sound levels, efficiency and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating.

C. Provide manufacturers data and inspection report that confirms transformers to be UL 1561 listed with K rating equal to that indicated on drawings.

D. Provide a connection schematic diagram.

E. Provide the following tests reports: Project Inspector will review the reports for conformance with specified criteria, and compliance with the applicable standards. Submit one copy for each set of shop drawings being submitted.

1. Load Losses: Measurements shall be taken at multiple load levels and plotted to show compliance with specifications and correlated to efficiency curve for the transformer size and type.

2. Provide No-Load and Total Losses report.

3. Applied Voltage.

4. Temperature Rise.

5. Induced Voltage.

6. Sound Level.

7. Impulse Test.

8. Manufacturer’s nonlinear load test representing real world load mix. Transformers not meeting this requirement shall not be installed.

F. Submit harmonics test plan as follows:

1. NEMA ST-20.

a. Open Circuit Test (no load losses):

1) Use for both Linear and non-Linear.

2) Measure Power.

b. Short Circuit Test (load losses):

1) Short Primary Winding.

a) Linear Test – complete with linear profile through secondary winding.

c. Non-Linear Test.

Harmonic Profile (K-7 Load)				
Harmonic Number	Rated % Current	Phase Shift		
		A	B	C
1	100.0	0	120	240
3	81.0	0	0	0
5	60.6	0	240	120
7	37.0	0	120	240
9	15.7	0	0	0
11	2.4	0	240	120
13	6.3	0	120	240
15	7.9	0	0	0

1) Complete with non-linear profile through secondary windings.

2) Measure Power.

2. Take data and graph efficiency per NEMA ST-20.

a. Graph-1 – Linear Loads 0 to 100 Percent Loads.

b. Graph 2 – Non-Linear Profile K-9 0 to 100 Percent loads.

3. Test Plans measuring Power IN and Power Out will not be accepted since procedures are not covered by any standard.

1.04 WARRANTY

A. Transformers shall be warranted to be free from defects in materials, fabrication and execution for a period of three years from the date of substantial completion.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Transformers manufactured by Siemens, Square D, General Electric, PowerSmiths, MGM, and Cutler Hammer or equal.

B. There shall be no openings through which foreign objects such as sticks, rods, wires, or the like might enter and contact live parts. Provide means for padlocking compartment doors.

a. Connection terminal points shall be bottom fed and located as far as possible below vent openings, or below top connections.

b. Terminals shall be protected from external/foreign objects contact.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Deliver, storage, protect and handle products in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

A. Transformer core frame shall be installed level on shock absorbing pads within enclosure. Comply with seismic requirements of CBC.

B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.

D. Transformers installed outdoors or below grade shall be mounted on concrete pads as specified in Section 03 3000: Cast-In-Place Concrete.

E. Install transformer ventilation openings not closer than 6 inches from wall surfaces.

F. Do not install transformers in corrosive environments such as swimming pool pump and boiler rooms, or similar areas.

3.03 VOLTAGE CHECK

A. Set taps on transformers to provide satisfactory operating voltages with present loads energized, including new loads and existing loads. A check shall be performed in the presence of the Project Inspector at a panel fed from each transformer, which is farthest from transformer. Voltages at transformers ranging from 118 to 122 volts inclusive, for 120 volt systems and proportionately equivalent for higher voltage systems are permitted.

B. Provide instruments and accessories required to perform checks. Voltmeters shall be accurate within .075 percent or one percent and shall have scales permitting voltage readings to be performed on upper half of scale. Calibration of the meters shall be observed by the Project Inspector.

C. Adjust transformer taps under full load operating conditions, to provide normal operating voltages at the loads.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

B. Repair scratched or marred surfaces affected during the execution of work. Repair surfaces shall match original finish.

END OF SECTION

SECTION 27 11 00
DATA NETWORK WIRING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Principal items of work shall include, but not be limited to, Customized Services, including:

1. Design services, which shall include the network connectivity design. Design will be developed based on the following:

a. Provide rack space and conduit space to allow a 40% expansion of the number of cable drops provided- at time of initial occupancy.

b. Provide Intermediate Distribution Frames (IDF) as indicated on the Construction Documents. There should be installed one (1) Intermediate Distribution Frame (IDF) on each floor of a multi floor building.

c. Provide installation of complete conduit system for installation of the Data Infrastructure fiber and copper cabling. Contractor is required to design and install the conduit system, including all pull boxes, for both the Inter-Building Pathways and Intra-Building Pathways communications system. The entire conduit system shall be provided on shop drawings.

d. Provide one l0/100/1000 Base-T switched port per workstation outlet present at time of initial occupancy.

e. Provide a minimum of one port 10/100/1000 switch port with auto sensing for workstation location and a minimum of 16 SFP-based 10 Gig Ethernet FX ports for each switch located in the MDF and IDF. Required is one 10/100/1000 port for each workstation outlet installed. The switch or switches provided shall have the following functionality:

1) Cisco-based/IOS Compliant.

2) 48 ports switch with Auto l0/l00/1000 TX with Auto Sensing Capability.

3) Minimum of four 10GBase built-in on 48 port switch, and minimum 16 SFP based 10GBase Fiber ports on MDF.

4) SNMP (MIB I, II compliant) RMON-9 Windows or NT platform.

5) Security - Segregated network, layer III switching/routing VLAN (ISL).

6) Multi-protocol Support Ready, IPV4 and IPV6.

7) IEEE 802.1p combined with two priority queues on 10/100/1000.

8) Up to 1024 port-based VLANs.

9) Support for standards-based IEEE 802.1Q and ISL VLAN

10) Trunking protocols.

11) TACACS+, IEEE 802.1D.

12) POE+.

2. Connectivity design documentation shall include:

a. Drawing of logical network configuration.

b. A material list specifying quantity and part/specification numbers.

c. Installation specifications.

d. Complete set of floor plans indicating entire system.

e. Cable Management Program, including:

1) Cable Schedule

2) Cable Test Forms

3) Cable Labels

4) Networking Planning Charts

5) CD-Rom Containing Design Data Base

3. Furnishing, installing, connecting and testing networking system including all components, cabinets, terminals, conduit and cabling system in accordance with design services furnished under this Specification.

4. The Contractor installing the structured cabling shall have an RCDD functioning as project manager. The Contractor's RCDD/project manager shall complete at a minimum the following task.

a. Review and submit Contractor's shop drawings

b. Conduct weekly site visits to review the installation and progress of the structured cabling during the communications installation phase of the project

c. Review and sign completed punch list items

d. Review and submit Contractor's as-built documentation

e. Provide required on site Supervision of installation to ensure a complete and working system

5. Design Services shall be in accordance with applicable American National Standards Institute (ANSI), Electronic Industry Association (EIA) and Telecommunication Industries Association (TIA) Standards.

6. Contractor Qualifications: Rowland USD requires only qualified and experienced Data Communications and Structured Cabling contractors perform design, project management, and installation services in the construction of PUSD structured cabling infrastructure. Pursuant to this, PUSD wants to ensure that successful contractors have the manufacturer authorizations, capabilities, qualifications, and experience to complete Telecommunications installations using common industry practices,(i.e. BICSI TDMM, ANSI/TIA/EIA, NEMA, NFPA, ETC) while meeting all PUSD guidelines.

   a. A contractor, by responding, represents that their company possesses the state license, manufacturer authorizations, qualifications, certifications, capabilities, test equipment, expertise, and personnel necessary to provide an efficient and successful installation of properly operating components, as specified.

   b. The Contractor bidding on Data Communications/Structured Cabling Systems specified herein shall be an Legrand Certified Contractor at a Ortronics Certified Installer Plus – Enterprise Solutions Partner (CIP-ESP), or Certified Installer Plus (CIP) contractor level. To provide a 20 to 25 year limited lifetime warranty. A copy of Contractor Certification documents must be submitted with the Submittals. The Data Communications/Structured Cabling contractor is responsible for the workmanship and installation practices in accordance with the Ortronics Program. Ortronics/Superior Essex will extend the nCompass™ Limited Lifetime Warranty to the end user once the Data Communications/Structured Cabling contractor fulfills all requirements under the NCompass Ortronics and Superior Essex Program.

   c. The Data Communications/Structured Cabling contractor must meet all training requirements from Legrand as a CIP-ESP or CIP contractor. The contractor must be in good standing with minimum 30% of the technicians on site and at least one manager current with the required training.

   d. The Data Communications/Structured Cabling Contractor is responsible for workmanship and installation practices in accordance with the Data Communications Division of Legrand Certified Contractor Program for copper and fiber installation.

   e. The Data Communications/Structured Cabling contractor shall provide copies of certificates for proof of manufacturer's training, manufacturer's certified installer, authorized distributor in the submittal and at the request of the Owner to verify compliance with specification.

   f. Contractor must be an approved Cisco Gold Partner and/or subcontractor to the contractor to perform the networking portion of the Specifications work. A copy of the certification documents must be submitted with the submittals. District will be supplying all the Cisco Equipment to be installed on any project that is covered by this Specification. Contractor will still be required to do the installation of the District supplied Cisco Equipment. Contractor is still required to be an approved Cisco Gold Partner to do the installation of the equipment and will still be required to configure all equipment at specified in this specification.

1.02 RELATED SECTIONS

A. Section 01 33 00: Submittals and Substitutions

B. Section 01 77 01: Project Close Out

C. Section 01 77 20: Project Record Documents

D. Section 01 77 40: Warranties / Guarantees

E. Section 0178 23: Operation and Maintenance Manuals

F. Division 26: Electrical

G. Section 26 00 01: Basic Electrical Requirements

H. Section 26 00 02: Basic Electrical Materials and Methods

I. Section 26 00 03: Raceways and boxes

J. Section 26 00 07 Cabinets and Enclosure

K. Section 27 11 23 Cable Runway

L. Section 32 23 17 Excavating Backfilling and Compacting for Utilities

M. Section 32 12 13 Site Concrete

N. Section 32 13 16 Pavement Repair

1.03 CODES AND STANDARDS

A. Installation Reference Standards (all codes and standards compliance will be to the most current revision available, including applicable addendums): Cable installation shall comply with the following:

1. NEC® 2011: National Electric Code®, 2011.

2. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises

3. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard

4. ANSI-TIA-568.2-d – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

5. ANSI/TIA/EIA-568-3-D – Optical Fiber Cabling Components Standard

6. ANSI/TIA/EIA-568-4-D – Broadband Coaxial Cabling and Components Standard

7. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.

8. ANSI/TIA-569-D-1 – Commercial Building Standard for Telecommunications Pathways and Spaces – Addendum 1

9. ANSI/TIA-606B – The Labeling and Record Keeping Standard for Telecommunications and Network Systems

10. ANSI/TIA-606-C – The Administration Standard for the Telecommunications Infrastructure of Commercial Building

11. ANSI/TIA-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications

12. ANSI/TIA-758-B – Customer Owned Outside Plant Telecommunications Infrastructure Standard

13. ANSI/TIA-862-B-1 – Building Automation Systems Cabling Standard

14. ANSI/TIA-526-7-A – Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant – OFSTP-7

15. ANSI/TIA-526-14-C – Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14A

16. ANSI/TIA-598-D – Optical Fiber Cable Color Coding (July 2014)

17. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers

18. ANSI-TIA-4966-1 – Telecommunications Infrastructure Standard for Educational Facilities

19. ANSI/TIA-5017 – Telecommunications Physical Network Security Standard

20. TIA TSB-162-A – Telecommunications Cabling Guidelines for Wireless Access Points

21. TIA TSB-184-A – Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling

22. BICSI-TDMM – Building Industries Consulting Services International, Telecommunications Distribution Methods Manual Revision 13, (use most current revision).

23. California Electrical Code

1.04 SYSTEM DESCRIPTION

A. The backbone Topology shall be the Star Topology consisting of graded index single mode optical fiber cable with the main distribution frame at the center of the star. The backbone cabling and pathway shall include all conduits, fiber optic cabling, connectors, patch cords and hardware to provide connectivity between the main distribution frames (MDF), the intermediate distribution frames (IDF) and the workstation outlets. Each (MDF) or (IDF) will have backup battery unit(s) as specified.

B. The horizontal Topology shall be the star Topology and shall consist of 4 pair Category 5e when installing into existing MDF/IDF locations or Category 6 when installing into new MDF/IDF locations, unshielded solid twisted pair cables. The horizontal system shall include the conduit and cabling between the wiring closet and the workstation outlets,

outlets, patch panels, patch cords, distribution racks, and all other components required for a complete cable plant. Each workstation outlet shall be connected to one port at the telecommunications room or closet (IDF) location. The maximum horizontal distance shall be 90 meters. This is the cable length from the connection at the telecommunications closet patch panel to the workstation outlet. Each building floor will have it's own Intermediate Distribution Frame (IDF) located on that floor and connected back to the Main Distribution Frame (MDF) via fiber optic backbone cable.. No station cable will be run between floors on a building with more than one floor.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00: Submittals.

B. Furnish catalog cut sheets, technical data and descriptive literature on components. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes and other pertinent data.

C. Shop drawings shall indicate conduit runs, pull boxes, equipment locations, wiring and schematics, details, panel configurations, sizes and a point-to-point wiring diagram of all circuits. Shop drawings shall indicate interfaces to equipment furnished by others, identifying numbers of wires, termination requirements, and other pertinent details. Responsibility for each end of interfaces shall be noted on shop drawings.

D. Entire system shall be supported by engineering documentation including:

1. Floor plans indicating all components, conduit runs, pull boxes, cable type, cabinet, fill and rough-in requirements.

2. Riser diagrams indicating all devices, cabinets and their point-to-point connections in a manner following floor plan layout.

3. Detailed rack layout diagrams must be submitted for the racks in each school closet, to include the clear identification of switches, copper and fiber optic patch panels, and rack expansion areas.

4. Diagrams must be submitted in format compatible with District requirements.

E. Each submittal shall be bound and shall contain an index organized vertically by assembly and item number and horizontally by columns. The first assembly shall be the major head end equipment. The leftmost column shall be the item number; next shall be the description, followed by the applicable specification section number, and followed by the specified item, which is followed by the submitted item. The rightmost column shall be for notes, which shall be used to reference the reason for submitting items other than as specified.

F. Each submittal shall contain product data sheets or catalog cut sheets for each item listed in the Index. These shall be arranged in the same order as the index and if more than one item is shown, the submitted items shall be highlighted or marked with an arrow. The product data shall be sufficiently detailed to allow the Engineer to evaluate the suitability of the product and to allow other trades to provide necessary coordination.

G. Drawings that are specific to this specification section shall be included in the submittal. "A" size, (8½"x 11"), and "B" size, (11"x17"), shall be bound into the manual. Larger drawings shall be folded and inserted into transparent envelopes that are bound into the manual.

H. Installation drawings which show devices from many specification sections shall be submitted separately. Contractor shall submit eight blue line copies and one reproducible copy of all such installation drawings.

I. Contractor shall provide a copy of the Ortronics Certified Installer Plus-Enterprise Solutions Partner (CIP-ESP) or Certified Installer Plus (CIP) Contractor Manufacturer's Certification.

J. Contractor shall provide a copy of the Technician and Manager Ortronics Certification's, for each Technician and Manager that will be working on this project.

K. Contractor shall provide six copies of complete submittal package.

L. Refer to customized services under this Specification for additional requirements.

M. Operating and Servicing Manuals and Record Drawings:

1. Deliver required copies of "Operating and Servicing Manual" for each system. Each manual shall be bound in a flexible binder and data shall be typewritten or drafted.

2. Each manual shall include instructions necessary for proper operation and servicing of system and shall include circuit diagrams of systems, a wiring destination schedule for each circuit leaving each rack, a schematic diagram of each component, and replacement parts numbers. Each manual shall also include as-built cable site plot plan indicating all cables both underground and in each building, and as-built coding used on each cable. Building floor plans shall indicate route of all conduit and cable runs.

3. Submit a transparency of plot plan and building plans, indicating location of equipment, conduit and cable runs.

4. Contractor shall maintain one set of plot and building plans labeled "Project Record Drawings" at site. Contractor shall denote all completed wiring runs in red.

1.06 QUALITY ASSURANCE/WARRANTY

A. Ordinances and Regulations: The work of this Section shall conform to California Code of Regulations, Part 3, and all other applicable codes and standards.

B. Only a qualified Contractor holding California State Licenses required by legally constituted authorities having jurisdiction over the work shall do work (C-7, C10 Contractors). Contractor shall have completed at least 5 projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years. Use equipment manufacturer's certified installers. Contractor will be able to produce certification upon Owner/District's request.

C. Spare Parts: Manufacturer shall warranty availability of spare parts for 10 years common to installed system.

D. Contractor shall warranty under nCompass Ortronics and Superior Essex Limited Lifetime Warranty Program that all work executed and materials furnished shall be free from

defects of material and workmanship for a period of 20 to 25 years from acceptance date of Contract Completion, not including specific items of work which require a warranty of a greater period of time as set forth in this Specification. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance of work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.

E. An nCompass Limited Lifetime Standard Compliant warranty will be required as described below for the following systems or system components.

1. Legrand and Superior Essex Communications LP (collectively, the “Supplier”) warrant to the end-user (“Buyer”) the nCompass CAT 5e U/UTP, CAT 6 U/UTP, CAT 6A U/UTP, Copper and OM1, OM2 Fiber Optic certified network cabling system installations will meet the defined ANSI/TIA-568 series industry specifications in effect at the time of product purchase Limited Lifetime for date of product installation (the “Standard Compliant Limited Lifetime Warranty”).

2. The Standard Compliant Limited Lifetime Warranty will be extended to include the entire channel provided that the applicable Legrand patch cords and Legrand equipment cords are utilized, and all products are installed within areas protected from outside elements. Channel warranties will support current or future applications that are approved by industry recognized organizations (IEEE, ANSI/TIA) for transmission over structured cabling systems defined by the ANSI/TIA-568 standard effect at the time of the installation. Channel warranties will perform to the specifications listed in the nCompass system data sheets in effect at the start of the installation. Supplier will honor claims on the Standard Compliant Limited Lifetime Warranty from the installation of the nCompass cabling system (the “Standard Compliant Limited Lifetime Warranty Period”).

F. If Contractor fails to repair or replace material or work indicated above within 15 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.

G. Persons skilled in trade represented by work, and in accordance with all applicable building codes shall install system in accordance with best trade practice.

PART 2 - PRODUCTS

2.01 EQUIPMENT STANDARDS

A. Where applicable all components installed under this Contract shall be listed by UL and approved.

B. All equipment and components shall be products of a single manufacturer except otherwise approved by the District.

C. Equipment Requirements:

1. In order to establish a standard of quality as required by the District, items of equipment indicated on Drawings and as mentioned in the Specifications, are chosen from products of various manufacturers. To further establish a reference for comparison of specifications that meet the District’s requirements, it is

understood that the manufacturer's published specification sheets on all items so named, are wholly embodied herein.

2. The District will accept only the following Manufacturer's equipment, described or called out in this document for use under this Contract:

   a. Middle Atlantic Products

   b. Ortronics by Legrand

   c. Superior Essex

   d. Utility Vault by Oldcastle Precast

   e. Polycom

   f. Cisco Systems, Inc

   g. Panduit

D. Equipment Substitutions: Equipment substitutions will not be accepted.

E. Contractor is required to protect all equipment from damage during construction. Equipment not protected and subsequently damaged by any contractor on the job site, shall be replaced at the Contractor's expense, upon written request of the District.

2.02 EQUIPMENT

A. Cabinets

1. Enclosed 26" D X 49" H, 24" W Usable Depth X 42" Usable Height, pivoting sectional wall mounted lockable cabinets (Middle Atlantic – DWR-24-26PD Series Rack with Plexi Front Door, and Fan Kit, DWR-FK26) for each IDF. The height of cabinet shall be enough to accommodate a 40% fill ratio, if the data drop count is above 72 the rack will be a (Middle Atlantic – SR-40-32 Series Pivoting Rack, with PFD-40 Plexi Front Door,40 RU Racks and Fan Kit, DWR-FK32) to meet the fill ratio. Cabinets shall be furnished with battery backup. The contractor shall furnish and install fiber and category 5e or 6 patch panels, and wire management of sufficient quantities to complete all distribution and termination.

2. All Middle Atlantic Racks will use the following keys, Front Doors – B399A-FD, Rear Doors – B644A-RD, Rear Rack Locks – B644A-RD.

3. All racks shall have a power strip installed, Middle Atlantic, 120 V, 15A, 9 Outlet 9' Cord Rackmount Power Strip, PD-915R-PL.

4. All new racks shall be labeled; each new MDF/IDF rack will be labeled as designated by the District with four (4) inch vinyl letters, White in color, from McMaster Carr Supply Co.

   a. Wall Mount DWR IDF Racks shall be labeled in the lower right hand corner of the front door on the plexiglass.

b. Wall Mount SR IDF Racks shall be labeled in the lower right hand corner of the front of the door on the plexiglass.

5. All IDF racks shall be mounted on a back board, consisting of ¾ inch Fire Resistant Plywood. Minimum to be sized the same size as the rack back, 24”x49”x¾” for DWR-24-26PD Rack, 24”x91”x¾” for SR-40-32 Rack, unless otherwise noted on drawings. Mount Backboard to non-Concrete Walls using 3/8”x3” Lags minimum six (6) lags with washers into studs, for Concrete Walls use 3/8”x5” Wedge Anchor minimum six (6) anchors.

6. All IDF racks shall be mounted to the back board using minimum 3/8”x 3” Lags with washers on non-concrete wall. On concrete wall mount the rack backpan and backboard are to be mounted together using 3/8”x5” Wedge Anchors.

7. Contractor is responsible to ensure that all equipment racks and enclosures shall be protected of all dust, debris and other environmental elements during construction until acceptance of system.

8. Contractor is required to protect all equipment from damage during construction. Equipment not protected and subsequently damaged by any contractor on the job site, shall be replaced at the Contractor’s expense, upon written request of the District.

B.Distribution Panels

1. Distribution Panels, Modular outlet Category 5e or Category 6 patch panels shall be as follows:

a. Category 5e or Category 6, patch panels (Ortronics) with wire management (Middle Atlantic) shall be, 24 and 48 port, patched 568B.

b. Data connectors for outlet shall be Category 5e or Category 6, 8-position RJ45, (Ortronics), 4 pair patched 568B.

2. Fiber patch panels shall be 12 to 72 ports for MDF/IDF, 19 inch rack mounted, lockable with Plexiglas door, no smaller that (Ortronics), OR-FC02U-P.

3. Cable terminations shall be patch panels 48 port, wired 568B Category 5e or Category 6, (Ortronics), OR-PHD5E6U48 or OR-PHD66U48.

4. Cable Wire Management hardware (1 (one) per Patch Panel) for all cabling in MDF/IDF’s fixed shall be Middle Atlantic, HCM-1D. Mount large ring side on top.

5. IDF cabinets shall be wall mounted with fan Kit DWR-FK26 (Mid Atlantic)

6. MDF cabinets shall be free standing with fan Kit (Mid Atlantic)

C. Workstation Data Connectors/Face Plates/Surface Boxes

1. Connectors for Faceplates: All Category 5e Keystone or Category 6 Keystone connectors shall be TechChoice series (Ortronics), 4 pair, 180 degree exit, and wired 568B, 8-position RJ45, OR-KS5EA-43 or OR-KS6A-43

2. Faceplate 2, 4, or 6 outlet, shall be single-gang, Fog White, TechChoice series (Ortronics), OR-KSFP2, OR-KSFP4, or OR-KSFP6.

3. Faceplate blanks shall be (Ortronics), OR-KSB10. To be used at any faceplate location that does not fill all the outlet holes with connectors.

4. Surface box if needed, shall be extra deep single-gang, ivory (Wiremold, Legrand, V5744)

D. Patch Cords

1. MDF/IDF Copper Patch Cords shall be Category 6, factory terminated and tested with Boot, 5 ft, 7 ft, and 9 ft lengths, (Ortronics), OR-MC605-00, OR-MC607-00 and OR-MC609-00. Use OR-MC605 for DWR-24-26PD Wall Mount Racks, Use OR-MC607 for SR-40-32 Series Pivoting Rack and MDF Racks, DRK19-44-36PRO.

2. Use this schedule for patch cable colors used in IDF/MDF to patch devices from patch panels to switches:

a.	Wireless devices	– Yellow patch cables	OR-MC60X-04
b.	POS devices	– Green patch cables	OR-MC60X-05
c.	PA devices	– Blue patch cables	OR-MC60X-06
d.	HVAC/Marquee devices	– Gray patch cables	OR-MC60X-08
e.	Security Surveillance devices	– White patch cables	OR-MC60X-09
f.	Phones/Data devices/UPS	– Black patch cables	OR-MC60X-00
g.	Servers Network Interfaces	- Orange patch cables	OR-MC60X-03
h.	Server IDRAC Interfaces	- Purple patch cables	OR-MC60X-07

X = length of cable, 5 = 5 feet, 7 = 7 feet, or 9 = 9 feet.

Using the same lengths as described above, Server may require longer cables.

3. The Minimum Bend Radius recommendations for Patch Cords are:

a. 4 times the patch cable diameter for 4 pair UTP or 24 mm (1.0 inch). Sharper bends that this will start to change the geometric relationship of the pairs to each other, and degrade electrical performance.

4. Provide one Patch Cable 9 ft length for each workstation outlet installed, Category 6, black, (Ortronics) OR-MC609-00.

5. Switch Cross/Connect Patch Cords shall be a Interconnect Cable, factory terminated and tested cross connect, 50cm, (Cisco) CAB-STK-E-0.5M, (Cisco Flex Stack 50CM Stacking Cable), CAB-STK-E-3M= (Cisco Blade switch 3M Stack Cable).

6. Fiber Patch Cords shall be factory terminated and tested LC connector to LC connector, (Ortronics) OR-P0RC8IPUZUZ002M,or OR-P0RC8IPUZUZ003M, 2 meter or 3 meter as required.

7. Fiber Patch Cord OR-P0RC8IPUZUZ003M is too be used in all Middle Atlantic, DRK19-44-36PRO, SR-40-32, and DWR-24-26PD Racks.

E. Data Networking Standards

1. The Data Networking Standard shall accommodate:

a. Ethernet: Star Configuration

b. Switched 10GBase (backbone)

c. Combination of switched 10/100/1000 Ethernet (Desktop)

d. TCPIP protocols

e. SNMP (MIB I, II compliant) RMON-9 Windows or NT Platform

f. Segregated network, Layer III switching/routing, and VLAN (ISL) for security

g. WAN (supplied by District)

F. Data Cabling

1. Four-pair, Enhanced Category 5e or Category 6 cable shall be installed from MDF/IDF locations to each station cable outlet via the station distribution conduit system, all cabling will be installed in conduit, no exposed cabling will be allowed. No J hooks, or Cable Tray allowed. Pull boxes, NO Four-s and Five-s boxes will be accepted as Pull Boxes in the data network installation, only Nema-1 or Nema-3, no smaller that 8X8X6, pull boxes are to be sized by the number of cables installed in them, number and size of conduits connecting to them and the cable bend radius. All conduit runs for station cables will be connected to Pull Boxes within the area the station conduits are located, there will be backbone conduit between the area Pull Boxes sized to the number of cabling in the conduit at 40% fill ratio. There will not be individual conduit runs from the IDF location to each station location. All station cable will be home runs between the station outlet and the patch panels, no cross connections or splicing. Station outlets locations will not be looped together in conduit runs. Each station outlet location will have its own conduit run from the station location to the pull box location. Cable shall be Blue PVC, Superior Essex Cobra® Category 5e Riser (52-200-25) or Superior Essex DataGain® Category 6 Riser (66-246-2A). Cable shall meet all requirements of ANSI/ICEA publication S-80-576, and EIA/TIA-568A/B. Cable will be terminated 568B.

a. Each building floor will have it own Intermediate Distribution Frame (IDF) located on that floor and connected back to the Main Distribution Frame (MDF) via fiber cable.. No station cable will be run between floors on a building with more than one floor.

2. When cabling is required to be installed through the underground conduit system the following cable will be required: Superior Essex Category 6 CMR/CMX Outdoor Sunlight Resistant Cable, 77-246-E1.

    a. Cable to be terminated per Fluke cable testing requirements for testing of Category 6 cabling, terminated with outlet jack, Biscuit, or RJ45 cable end.

3. Wire Management hardware (1 (one) per Patch Panel) for all cabling in MDF/IDF's fixed shall be Middle Atlantic, HCM-1D , straps shall be Ortronics, Velcro strapping shall be Panduit Tak-TY Hook & Loop Cable Ties HLS type, color Black, width .75"/19mm

G. Fiber Cabling

1. The fiber optic cable shall be Superior Essex Series 53, 12 strand, Single Mode, Indoor/Outdoor, using dry water blocking system, ANSI/TIA/EIA-568A/B 53012K101 (BLA), (Superior Essex), G.675.A1 TeraFlex, and shall consist of, but not limited to, the following components:

    a. Loose Tube buffered optical

    b. PFM Gel filled

    c. All Dielectric design

    d. 900 micron tight buffered optical fibers

    e. Protective outer jacket

        1) The cable shall be Superior Essex. Cable shall be for use in indoor and outdoor applications and shall have the following characteristics:

            a) Numerical Aperture: 0.275 $\pm$ 015

            b) Coating Diameter: 250 $\pm$ 10 micron

            c) Cladding Diameter: 125.0 + 0.7 um

            d) Attenuation (dB/km) - Typical 0.32/0.18

            e) Maximum @ 1310/1550 nm 0.7/0.7

            f) Wavelength (nm) 1310/1550nm

2. Fiber terminations in fiber patch panel shall be, (Ortronics) – OR-205KAN9GA-SM Anaerobic LC SM 900um Connector

3. Fiber connectors for fiber panel shall be a 12 pack adapter panel, OR-OFP-LCD12AC (Ortronics)

4. Fiber Patch Panel Blanks – OR-OFP-BLANK – number required filling any empty locations on the Fiber Patch Panel

5. Fiber Optic Breakout Kit – Loose Tube Cables – 12 fiber – Ortronics OptiMo Breakout Kit
– OR-61500858

6. Fiber Optic Splitter Kit – Loose Tube Cables – 12 fiber – FOnetworks Unitube Splitter Kit– SPKU-12

H. Inner Duct

1. All fiber cable shall be installed in one and one-quarter inch (1-1/4”) inner diameter high-density polyethylene innerducts with pre-installed one-quarter inch diameter polyester pull ropes. The innerducts are to be orange in color and are to be of corrugated design to be installed in larger conduit. Provide 3 Innerduct in all 4” data system conduits, 2 Innerduct in all 3” data system conduits, and 1 Innerduct in all 2" data system conduits. The Innerduct shall conform to material standards for fiber-optic cable Innerduct, including Plastic Pipe Institute Standards.

2. Innerduct will be installed into all Conduits and Manhole for Fiber Optic Cabling. Innerduct will extend from the conduits entering buildings to the IDF/MDF rack or ladder racking if installed. Any question on innerduct requirements should be directed to the District.

I. Battery Backup for IDF

1. Shall be rack mountable (Tripp-Lite), Smart Online Expandable Rack/Tower UPS System - Model # SU1000RTXL2U, Series AGPS5180, with External Battery Pack - Model # BP24V28-2U, Heavy Duty Mounting Ear Kit – Model # UPSHDEARKIT, Internal SNMP/Web Management Accessory - Model # SNMPWEBCARD, external Environmental Sensor Accessory – Model # ENVIROSENSE, one per IDF rack, One complete UPS unit for each two switches in each IDF cabinet, if there are more than two switches, there shall be an additional complete UPS unit for each additional switches as required, on a multiple of one UPS unit for each two switches.

J. Steel Conduit and Pull Boxes

1. Install rigid conduit were required to meet National Electrical Code Article 346.

2. Install EMT conduit per this specification and construction documents. Supplying all data network wiring system cabling installed into the installed conduit system. Installation of Conduit System is to be installed using Approved Shop Drawings.

3. Conduit Fill Ratio: provide conduit sizing to allow a 40% fill.

4. Pull boxes, size pull boxes for number of cables, bend radius and connected conduits, also provide at least one service loop inside each pull box, NO Four-s and Five-s boxes will be accepted as pull boxes. No LB’s will be accepted as pull boxes or any part of the conduit installation.

5. Ensure that there is a minimum of at least one cabling service loop installed into every pull box installed.

6. Conduit shall be installed from MDF/IDF locations to each station cable outlet location, all cabling will be installed in conduit, no exposed cabling will be allowed. No J hooks, or Cable Tray allowed. Pull boxes, NO Four-s and Five-s boxes will be accepted as Pull Boxes, only Nema-1 or Nema-3, no smaller that 8X8X6, pull

boxes are to be sized by the number of cables installed in them, number and size of conduits connecting to them and the cable bend radius. NO LB's will be accepted in place of pull boxes. All conduit runs for station cables will be connected to Pull Boxes within the area the station conduits are located, there will be backbone conduit between the area Pull Boxes sized to the number of cabling in the conduit at 40% fill ratio. There will not be individual conduit runs from the IDF location to each station location.

7. In locations where the Nema 1 pull boxes will be exposed to the public the lid screws are required to be "tamper-resistant" screws. Tamper-Resistant screw type required will be a Hex-Pin type. Contractor will be required to replace the screws that come with the Nema 1 Pull Boxes with the "tamper-resistant" screws.

8. See Addendum 1 for additional Pull Box requirements.

L. Ladder Racking (Cable Runway) and Components

1. Install Ladder Racking (Cable Runway) to meet the requirements of this specification and drawings

2. Manufacturer shall be – CPI, Chatsworth Products, Inc.

3. Contractor shall use only UL Classified Cable Runway

4. Cable Runway supports backbone and horizontal cables between the point of entry and exit into the telecommunications and equipment rooms, and cross-connects on racks or cabinets with other products.

5. For Cable Runway Contractor shall adhere to Specification Section 27 11 23 for material and installation.

M. CISCO Systems VOIP Phones (Contractor Provided and Installed)

1. Provide One (1) Cisco Six Line VOIP Phone, CP-7861-K9=, for the Main School Phone

2. Provide One (1) Cisco Four Line VOIP Phone, CP-7941-K9=, for each staff phone location

3. Provide One (1) Cisco Two Line VOIP Phone, CP-7821-K9=, for each classroom location, wall mounted by door

4. Provide One (1) Cisco Wallmount Kit for Cisco Phone 7800 Series, CP-7800-WMK=, for each phone CP-7821-K9= to be wall mounted, i.e. classrooms or other required locations.

5. Contractor will be required to fill out the Dial Plan Spreadsheet supplied to the contractor by the District for IP phone configuration

6. Contractor will be required to return the Dial Plan Spreadsheet to the District, so the District can have our vendor setup the new phones per the dial plan spreadsheet.

N. Cisco Aironet Series Access Point (Owner Supplied, Contractor Installed)

1. Provide One (1) Interior Cisco Aironet 3800 Series Access Point AIR-AP3802I-B-K9, CON-SNT-AIRPIBK9, AIR-AP-BRACKET-1(one per AP), AIR-AP-T-RAIL-R(one per AP) SW3802-CAPWAP-K9(one per AP) LIC-CT5520-1A(one per AP), C1F3UAIRK9(one per AP), CON-ECMU-C1FPAI1K(one per AP) for each identified location. The Contractor shall install a minimum of one (1) access point per all Classrooms, two (2) access point per Multipurpose Room, one to two (1 to 2) per Library depending on size, one (1) per Staff Lounge, two (2) Elementary School Administration Areas, six (6) for Middle and High School Administration Areas, one (1) per Portable Building Classroom, two (2) per Auditorium, one (2 to 4 based on size) per Gym and any additional locations identified on Drawings.

2. Provide One (1) Exterior Cisco Aironet 1500 Series Access Point AIR-AP1562E-B-K9, CON-SNT-AIRBAP15 (one per AP), SWAP1560-LOCAL-K9 (one per AP), AIR-ACC1560-PMK1 (one per AP), AIR-ANT2547V-N (one per AP), LIC-CT5520-1A (one per AP). The Contractor shall provide and install access points as identified on Construction Drawings.

3. Provide required Licensing for each Access Point to be added to the Wireless Controller (AIR-CT5520-K9).

4. Installation of Cisco Aironet Series Access Points is to be by Manufactures best practice. All Cisco Access Points are to be configured by the Contractor using a Certified Cisco Gold Partner onto the District Wireless Controller (AIR-CT5520-K9).

5. All access points are to be ceiling mounted where possible onto drop ceiling. Ceiling mounted locations onto drop ceiling grids are to use the Cisco Grid Clip mounting bracket, AIR-AP-T-RAIL-R (Recessed), AIR-AP-T-RAIL-F (Flush), or Channel Rail Adapters AIR-CHNL-ADAPTER. Any locations that are not drop ceilings or would require the access point to be mounted on a wall will use the following part for mounting, (Oberon
– Model 1011-00, Right-Angle Wall Bracket – Multi-vendor AP). Any exterior locations will use the, (Tessco – Model M338273, TERRAWAVE Part No. 12106OPOLYF-OO-RT, 12X10X6 Polycarbonate NEMA 4X Enclosure). All access points are to be mounted in the vertical position, NO vertically mounted access points will be accepted by the District.

6. All cabling for Cisco Aironet Series Access Points will be installed into conduit. Some locations may require the use of Wiremold for installation, V700 Wiremold is acceptable. Conduit and Wiremold is to be installed by contractor doing the installation of the access points as part or their work. Installation of the conduit and Wiremold will be done by associated District Specifications.

7. All installed Cisco Aironet Series Access Points are to be configured onto the District Cisco Wireless Controller (AIR-CT5520-K9). All Access Points are to be supplied with a license for additional Access Points to be added. The Contractor will be responsible for accruing licenses to support the install of the Cisco Aironet Series Access Points.

2.03 INTERBUILDING COMMUNICATIONS CONDUIT SYSTEM (ICCS) - MANHOLES/VAULTS

A. Pull Box - 4x4x4 w/ traffic rated lid marked signal (Old Castle Precast, Inc. – C10-1345)

B. Access Box -4x6x6 w/ riser and lid marked signal (Old Castle Precast, Inc. – C10-1347)

C. Extension Ring for existing 4x4x4 Pull Box (Old Castle Precast, Inc.)

D. Extension Top for existing 4x4x4 Pull Box (Old Castle Precast, Inc.)

E. All manholes/vaults/extensions shall only be approved by the District prior to installation.

F. The underground communications vaults are located wherever a significant change in the direction of a conduit bank is necessary or a building feeder intersects the ICCS or where there are more than 100 feet in the conduit run. These vaults provide access for installation of the low voltage communications systems. Manhole/vaults are labeled Signal in the form of raised welds on the cover.

G. All underground communications vaults are to be set 1 inch above finish grade. This is to limit water into vaults. Surrounding finish grade from the box is to be sloped out from the vault existing finish grade at a 30 degree angle.

H. All underground PVC conduits are to be terminated to the underground communications vaults using the provided built in terminators. Use required reducers when needed to terminate a smaller conduit to any of the terminators as required.

I. Contractor is required to ensure the Manhole/Vaults is installed on a base of 18 inches of crushed rock for drainage. Contractor is required to ensure that the sump is broken out of the bottom on all installed Manhole/Vaults for drainage.

J. Contractor is required to request that the District Inspector, inspect all underground conduits and Manhole/Vaults prior to them being buried, either by 3 sack slurry, or sand and native dirt. No Communications Underground conduits are to be encased in concrete.

K. Any damaged Manhole/Vaults by the installing Contractor will be replaced by the Contractor at the Contractors cost, the contractor will receive written request from District of any replacement, Manhole/Vaults damages will be determined by the District Inspector. This can occur any time up to completion or final inspection of the project and the District has accepted the project. This will hold all contractors working in and around the Manhole/Vaults responsible for any and all damages that they cause to the Manholes/Vaults. Thus the District will do inspections as required to ensure each contractor installing or working inside of Manhole/Vaults do not cause any damage to the Manhole/Vaults they are accessing.

L. Access Boxes

1. The interior of a “Access Box” is at least 4 feet by 6 feet in plan, and 6 feet height. The 6 foot sides are used for main feeder conduit bank penetrations, which are from the main distribution. The 4 foot sides are used for branch conduit bank penetrations to pull boxes. Access Boxes are capped with Neck Section 36”-30”x6” by a 30 inch round lid. Contractor grout all joints as required. Contractor required to supply one ladder for accessing of each Access Box. Ladder provided will have first rung within 12 inches of the top of neck.

M. Pull Boxes

1. The interior of a “Pull Box” is at least 4 feet by 4 feet in plan, and 4 feet height. The pull box is required to accommodate a change in direction of the communications conduit bank. The conduit bank usually penetrates two adjacent sides. Pull Boxes are capped with a traffic lid.

N. Pull Box Extensions

1. In the event that a “Pull Box” will require to be raised from its current elevation to a new elevation due to a change in the surrounding landscape. Then the Contractor will be required to contact vendor “Old Castle Precast, Inc.” to have them build the required extension for the 4x4x4 Pull Box. This extension will sit directly on top of the existing Pull Box, and thus will require that the existing traffic rated lid be removed. It will be the contractor’s responsibility to remove and dispose of the old, removed traffic rated lid properly. Contractor is responsible to ensure that “Old Castle Precast, Inc.” has the correct size required to build the correct size extension.

O. Securing Cables

1. All Manhole/Vaults require racking and cable hooks installed on all four sides of the Manhole/Vaults. Two (2) 18 Hole ,thirty-six (36) inch Cable Rack W/O TAB TEL will be placed on each side (wall) on the Manhole/Vaults. Spaced out evenly and vertically on each side of the Manhole/Vault. There will be two (2) 7 ½ inch Cable Hooks (Shoes) installed onto each of the 18 Hole Cable Racks. Cables are to be secured with cable ties to the 7 ½ inch Cable Hooks. Cable Hooks must not be overloaded and thus if required the Contractor is required to add any additional Cable Hooks (Shoes) as required.

2. All Access Box require racking and cable hooks installed on all four sides of the Manhole/Vaults. Two (2) 18 Hole ,thirty-six (36) inch Cable Rack W/O TAB TEL will be placed on each side (wall) on the Manhole/Vaults. Spaced out evenly and vertically on each side of the Manhole/Vault. There will be two (2) 7 ½ inch Cable Hooks (Shoes) installed onto each of the 18 Hole Cable Racks. Cables are to be secured with cable ties to the 7 ½ inch Cable Hooks. Cable Hooks must not be overloaded and thus if required the Contractor is required to add any additional Cable Hooks (Shoes) as required

3. Do not over tighten the cable ties around the cabling. Snug only. Use Stainless Steel Cable Ties for attaching low voltage cabling to racking shoes.

P. Cabling Routing Within Manhole/Vaults

1. In general, cable routing within Manhole/Vaults must meet the following criteria to be acceptable.

   a. Minimum of one service loop for all cabling installed into Manhole/Vaults

      1) Service loop consist of one entire loop around the inside of the Manhole/Vault.

   b. Cable loops and excessive slack shall not be left in Manhole/Vaults.

   c. The center of all Manhole/Vaults must be kept clear of cable/wiring.

   d. Installed cables must not block access to unused conduits or built in terminators.

   e. Cables must not arbitrarily block blank wall space.

f. Cables must not be secured to other cables.

g. All cabling must be firmly secured to installed hangers on Manhole/Vault walls, using the hanger shoes, add any additionally required shoes as needed to adhere to installation requirements, use Stainless Steel S.

h. Installers must adhere to bend radius restrictions particular to specific cable type being installed.

i. Fiber Optic cable must be installed in inner duct and labeled as fiber optic cable.

j. Contractor will install Cal Am Manufacturing Wedge Seal Brand Simplex/Multiplex Duct Plug for all conduits with Inner Duct installed at each end. Use Cal Am Manufacturing, Wedge Seal 3-Way 4" Duct Sch. 40 Underground Fiber Optical/Electrical Seal, 7340-125, for 1 ¼ inch Inner Duct.

k. Each cable must be labeled at every transition through a Manhole/Vault, entering and leaving conduits.

l. Installers must ensure there is a pull cord left in all conduits after cabling is installed into conduit or any empty conduits. This will be a ¼ inch nylon rope.

m. Contractor will install at each end of any empty conduits in the underground conduits system, Kwikie Plug Brand Mechanical Duct Plugs with Loop Nut, manufactured by Cal Am Manufacturing. 4" Kwikie Plug, with Loop Nut (5120-40L0) and 2" Kwikie Plug, with Loop Nut (51420-20).

Q. Underground Conduits/Backfill

1. All underground conduits will be installed per construction documents.

2. All underground conduits installed, without and cabling installed into them, will be sealed at each end inside of the manhole/vaults with

3. Underground conduit backfill will be sand or native soil; or two (2) sack slurry with the last eighteen (18) inches native soil if in landscape area, twelve (12) inches road base and then the asphalt if in traffic area.

4. DO NOT use concrete to encase the low voltage conduits.

5. All transitions from horizontal underground conduits to any vertical conduits will be using a minimum of a 3 foot sweep in the matching conduit size.

6. All transitions from PVC conduit to Rigid or EMT conduit will be wrapped with a 30 Mil tape to protect the conduit from moisture, up to eighteen (18) inches above finish grade.

2.04 KEYS AND LOCKS

A. Contractor shall provide to the District all keys and locks for all cabinets and equipment for access to service equipment.

2.05 DATA NETWORK EQUIPMENT (OWNER SUPPLIED, CONTRACTOR INSTALLED)

A. Workgroup, Ethernet switches in Intermediate Distribution Frame shall be 48 port auto 10/100,1000, SNMP, RMON-9, 2 uplink modules/ports SFP+, C3KX-NM-1G, -MACsec, OSPF, IPV4, IPV6, (Cisco WS-C3850-12X48U-S Port Full PoE IP Base with 4 SFP), provide switches required to connect all data ports on patch panels in each IDF cabinet. Switches will comprise of the following: WS-C3850-12X48U-S, CAB-SPWR30CM= (one per switch when more than one switch per IDF), STACK-T1-50CM (one per switch when more than one switch per IDF), C3850-NM-4-10G one per switch, installation requires SFP-10G-LR= 10GBase-LR SFP Module, two per IDF location, and two per MDF location. If the core is not the 10G equipment, then use GLC-LH-SMD=, for fiber connections. All switches will include SMARTNET 8X5XNBD, (CON-SNT-WSC385US). Each IDF will have the top and bottom switch connected via fiber back to the MDF core, SFP-H10GB-CU5M= (provide one for each switch or switch stack)

B. Backbone Ethernet switches in Main Distribution Frame shall be auto 10/100/1000TX Ethernet-channel, redundant power, RMON-9, for Elementary, Middle and High School equipment is Cisco Systems WS-C4500X-24X-ES or WS-C4500X-40X-ES (determined by the number of fiber connection required per MDF Cabinet), C4500X16P-IP-ES or C4500X-24P-IP-ES, C4KX-NM-8SFP+(1 for WS-C4500X-24X-ES)(2 for WS-C4500-40X-ES), KX-PWR-750AC-R(1), C4KX-PWR-750AC-R/2(1), CAB-US515-C15-US(2), Con-SW-WSC24EXX) or CON-SW-WSC45X40XE). SFP-10G-LR= (two per fiber cable termination), SFP-H10GB-CU5M= (provide one for each switch or switch stack to be connected).

C. Router shall be CISCO3925-V/K9, 3900-FAN ASSY(1), C3900-SPE100/K9(1), FL-CUBEE-25(1), HWIC-BLANK(1), ISR-CCP-EXP(1), MEM-3900-1GB-DEF(1), MEM-CF-256MB(1), PVDM3-64(1), PWR-3900-AC(1), SL-39-IPB-K9(1), SL-39-UC-K9(1), SM-D-BLANK(1), SM-S-BLANK(2), CAB-AC(2), CON-SNTE-3925V(1), EHWIC-4G-LTE-V(1), 4G-AE010-R(2), 4G-LTE-ANTM-D(2), FL-CME-SRST-25(3), FL-SRST(1), PWR-3900-AC/2(1), VIC2-4FXO(1), VIC3-4FXS/DID(1), for Elementary Schools , Middle Schools and High Schools.

D. All Cisco Data Network Equipment shall to be configured by the Contractor using a Certified Cisco Gold Partner. Any IDF or MDF requiring more than one Cisco Switch will be Stacked use the Cisco provided cabling and configured as a switch stack. Virtual Switch Stack numbering will match physical switch stack location.

E. All Cisco Data Network Equipment switch shall be configured to District specifications at time of project using supplied configuration template and District supplied Data Network Standards.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All of the Data Infrastructure Cabling System will be installed in conduit and in accordance with best trade practice by persons skilled in trade represented by the work, and in accordance with local building codes and applicable provisions of the California Electrical Code, or specification Division 26, as is most stringent.

B. All electrical materials and equipment installed shall be of new manufacture, and approved by Underwriters Laboratories, Inc. (UL), and shall bear the UL label.

C. Conduits for the data network system will consist of trunk conduits sized to accommodate the cabling through the building with pull boxes located in each location that branch runs

from pull boxes need to be located for each data outlet location, locate pull boxes in accessible spaces for access. See Addendum 1 for conduit cable fill.

D. Location of outlet boxes and equipment on drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wire ways, drops and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other work already in place, and must be ascertained by Contractor in the field prior to start of work.

E. Pulling Twisted Pair Cabling: Avoid kinks, knots, and twisting during installation of cable. Adhere to the maximum pulling tensions of the specified cable that it shall not be exceeded and proper radius of all cable bends shall be maintained. Ensure EMI condition distances are met.

F. Pull Optical Fiber only by the aramid yarn strength member. Whether using Kellum Grips or a “dog latch”, the pulling eye end must have a swivel to keep from twisting the optical fiber (be aware of brake-away rating). All backbone cable must be supported between each floor. Adhere to Optical Fiber Tensile Load and Bend Radius during installation.

G. Lubricants can harden like varnish and corrode the cables and pathways and can void warranties. It is the contractor’s responsibility to verify with the cable manufacturer if using lubricants will void the warranties. Alternatives to lubricants include installing MaxCell woven tubes or using Talc

H. Conduit types shall be limited to rigid metal conduit, electrical metallic tubing and schedule 40 PVC, as permitted under section 26 00 02. FLEXIBLE METALLIC CONDUIT SHALL NOT BE USED, due to cable abrasion problems. Liquid tight conduit is acceptable when approved by the District for use. Get prior approval from District before use of Liquid Tight Conduit in installation. J Hooks and Cable Tray will not be accepted in place of conduit.

I. Pull boxes, NO Four-s and Five-s boxes will be accepted. Pull boxes, Nema 1, no smaller than 8X8X6, size pull boxes for the number of cables and bend radius. Use pull box sizing standards for size of pull boxes.

J. No section of conduit run shall be longer than 100 feet and contain more than two 90° bends between pull points or pull boxes. Such pull boxes must be located to provide free and easy of access. All pull boxes shall have at least one service loop of the horizontal cabling inside of the pull box.

K. The inside radius of a conduit bend shall be at least 6 times the internal diameter of the conduit. When the conduit size is greater than 2 inches, the inside radius shall be at least 10 times the internal diameter of the conduit. For fiber optic cable, the inside radius of a conduit bend shall be at least 10 times the internal diameter of the conduit.

L. Conduit shall be sized as per table 4.4-1 of -EIA/TIA-569 standard.

M. Conduit minimum size will be no smaller than ¾” for Category 5e cable and 1” for Category 6 cable.

N. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.

O. Conduit couplings and connection fittings shall be compression fittings. Use Myers Hubs where required for water tight connections.

P. Pull boxes shall not be used for splicing cable.

Q. A pull box shall be placed in a conduit run where:

1. The length is over l00 ft.

2. There are more than two 90-degree bends.

3. If there is a reverse bend in the run.

4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

R. All pull boxes will have at least one service loop of cable installed into the pull box.

S. Twisted Pair Cable Service Loops: Providing additional slack at both ends of cable runs during installation will accommodate future cabling system changes and repairs. BICSI recommends providing cable slack/loop as follows:

1. 3 m (10 ft) in the MDF/IDF location

2. 300 m (1 ft) at the outlet

3. One loop in each pull box

4. Cable slack/loop at the outlet end of the cable run should be in the ceiling or pull box and should not be forced in the outlet box. Do not store slack/loop in bundled, round coils. Cable coils can degrade cabling performance since they will act as an electrical coil. Cable slack/loop should be stored in and extended loop configuration. Ensure to include the slack/loop in the maximum length of the horizontal cable, so as not to exceed the 90m (295 ft) limit.

T. Fiber Optic Cable Service Loops: Cable slack or service loops should always be provided for changes and possible repairs. The recommended service loop length for optical fiber is:

1. Backbone Distribution – 15.2 m (50 ft)

2. Horizontal Distribution – 2.6 m (10 ft)

3. Work Area Outlet – 1 m (3.1 ft)

U. Modular Patch Panel Termination: Horizontal cable runs terminated on the back of patch panels should leave the panel at right angles, then sweep gently along the provided cable support bar and be secured with Velcro. Bring the cable into the center of the C4 clips and fan the pairs evenly.

V. Fiber Patch Panel Installation and Termination of Fiber

1. Fiber Patch Panels are to be installed into IDF and MDF racks in the top, leaving 1 U space at the top. See Addendum 2 for layout.

2. Fiber Patch Panels are to have blank inserts installed into all empty adapter panel locations.

3. Contractor is required to install the Fiber Cable into the Fiber Patch Panel per industry standards utilizing provided components with the cabinet.

4. Contractor is required to ensure fiber bend radius compliance and install into strategically positioned receptacles for a secure installation and optimum fiber protection.

5. Contractor is required to ensure fiber patch cord exit without any kinks or bends from the fiber patch panel (cabinet).

6. Contractor is required to install the fiber index card into the fiber patch panel per manufacturer requirements.

7. Contractor is required to install PTouch labels into each MDF Fiber Patch Panel with name for each fiber installed and affixed to the index card, aligned with the installed fiber. i.e. 12 STRAND SM MDF TO IDF-XX, 24 PT, Helvetica Font. The XX is the IDF designation, District will provide the IDF designation.

8. Contractor is required to install PTouch labels into each IDF Fiber Patch Panel with name for each fiber installed and affixed to the index card, aligned with the installed fiber. i.e. 12 STRAND SM IDF-XX TO MDF, 24 PT, Helvetica Font. The XX is the IDF designation, District will provide the IDF designation.

W. Pull boxes will be sized by industry standards.

1. The sizing requirements for Pull Boxes, Junction Boxes, and Conduit Bodies exist to prevent conductor insulation damage. Those requirements are in TIS/EIA 568/569, and they apply to all conductors 4 AWG and larger.

2. No Pull Boxes smaller that 8x8x6 will be allowed. Base the Pull Boxes size based on the number of conduits connected to them and the number of cables installed through them.

3. All Pull Boxes are required to have a minimum of one service loop installed.

X. Where a pull box is used with raceway(s), the pull box shall:

1. For straight pull through, have a length of at least 8 times the trade-size diameter of the largest raceway/conduit;

2. For angle and U pulls:

a. Have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest raceway, this distance being increased by the sum- of the trade-size diameters of the other raceways on the same wall of the box.

b. Have a distance between the nearest edges of each raceway/conduit entry enclosing the same conductor of at least:

3. Six times the trade-size diameter of the raceway/conduit; or

4. Six times the trade-size diameter of the larger raceway/conduit if they are of different sizes.

5. For a raceway entering the wall of a pull box opposite to a removable cover, have a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway/conduit plus 6 times the diameter of the largest conductor.

6. Conduits for the data network system will consist of trunk conduits sized to accommodate the cabling through the building with pull boxes located in each location that branch runs from pull boxes need to be located for each data outlet location, locate pull boxes in accessible spaces or available crawl spaces for access.

Y. All conduits shall be clearly labeled at both ends designating the closet by number, which includes the sequential numbering of the conduit originating at that closet. Conduit length shall also be indicated on the label. Pull-boxes shall be labeled on the exposed exterior.

Z. Drawings generally indicate work to be done, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other work already in place. Contractor shall carefully investigate conditions where conduits and wire ways are to be installed, and furnish and install required fittings.

3.02 RECORD DRAWINGS

A. Contractor shall return all project record documents (Drawings and Specifications) to the District at completion of the work. Drawings shall be marked by Contractor to indicate all conduit runs, pull boxes, additions, deletions, or changes, including changes to Cable Schedule. It is intended that these marked-up Drawings constitute the “as-built” configuration of the work. Where no changes have occurred, Contractor shall mark such Drawings “No Change”. Also see 3.05 CERTIFICATION, TESTING AND DOCUMENTATION, Part I, As Builts for additional As Built requirements.

3.03 TOPOLOGY/CONFIGURATION REQUIREMENTS

A. Data Network - General

1. User Stations

a. Complete conduit system for cabling (Optical Fiber/Cooper).

b. Ethernet (UTP)

c. Enhanced Category 5e or Category 6 to Data Outlets (Ortronics)

d. Minimum Eight Dual outlets per classroom, spread throughout the room, One single ceiling mounted outlet for projector, One single ceiling mounted outlets for Wireless Access Points, opposite corners of the room

e. Minimum Five Dual outlets per office areas as identified on Construction Documents, two single ceiling mounted outlets in office areas for Wireless Access Points, or as provided on construction documents

f. Minimum Sixteen Dual outlets per Library, spread throughout the room, Two ceiling mounted outlets for projectors, five ceiling mounted outlets for Wireless Access Points, spread throughout the room

g. Minimum Thirty Two Dual outlets spread throughout each Computer lab, Two single ceiling mounted outlets for projectors, Two single ceiling mounted outlets for Wireless Access Points

h. All data cabling will be home run to the IDF or MDF cabinets, from outlet locations to Category 5e or Category 6 patch panels, no cross connecting or splicing of cables

i. Each building floor will have its own Intermediate Distribution Frame (IDF) located on that floor and connected back to the Main Distribution Frame (MDF) via fiber cable. No station cable will be run between floors on a building with more than one floor.

j. All Enhanced Category 5e or Category 6 data cable will be installed in conduit with wall outlets and or surface mounted 2400 or 4000 Wiremold, if not installed inside the wall in conduit.

k. Outlets will be numbered using the following scheme IDF # and D- patch panel outlet number, ports on patch panel or panels are numbered contagiously

l. Patch Panel shall be labeled to designate port number, number ports contagiously, 1, 2, 3, 20, 30 and so on

m. All User Station Cabling is to be free from grounds, shorts, opens, polarity reversals, and split pairs.

n. Above mentioned shall be provided by the contractor unless otherwise directed by the District

2. Backbone

a. One twelve (12) strand single mode, Indoor/Outdoor fiber optic cable Superior Essex 53012K101

b. Fiber Breakout Kit – Ortronics OR-61500858, FOnetworks 6 Unitube Splitter Kit SPKU-12

c. LC connectors for termination of fiber, Ortronics OR205KAS9EA-09

d. Home run from each IDF Rack to MDF Rack

e. Provide all required tools, materials, consumables, and equipment necessary for cleaning and field termination of optical fiber connectors. Label each end of each cable as to source and destination. Terminate optical fibers in consistent, consecutive manner at each end. Label Optic Fiber cable with yellow “Caution Optical Fiber Cable” tags at each fiber termination point.

f. The Twelve-Strand single mode fiber optic cable will be installed in Innerduct through conduit and inside of underground Manholes/Vaults when underground, providing a service loop in all Manholes/Vaults and pull boxes.

g. Optical fiber cable terminations shall utilize enclosures and components in quantities consistent with the required fiber counts at each end of each segment. During field polish optical fiber connector termination, visually inspect all terminations with a 400-power microscope. Follow all the connector manufacturer's recommendations. Unacceptable flaws in the terminations will include, but not be limited to, scratches, full or partial cracks, bubbles, pits, epoxy residual, dirt, dust, oil, moisture, grinding and sanding debris. The acceptable termination will show a connector tip that is free of all imperfections in 100% of the core and 80% of the cladding. All unacceptable connectors shall be inspected after rework.

h. During installation of optical fiber cable, do not allow pulling tension to exceed cable manufacturer's specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.

i. All optical fiber connector tips shall be cleaned with the proper cleaning tools specifically designed for optical fiber, prior to inserting them into matting receptacles or bulkheads.

j. Conduit installation between buildings will be in trenches (underground) unless otherwise noted on the Construction Documents

k. Above mentioned shall be provided by the contractor unless otherwise directed by the District

3. MDF/IDF Build-Out

a. Each MDF will consist of one lockable free standing security cabinet with Ventilated Door and Fan (Mid Atlantic DRK Series) in each MDF, (DRK-19-44-36*,with SPN-44-36, DPVFD-44) located per Construction Documents. All screws used for mounting of equipment into racks will be, Mid-Atlantic 6MM Cagenuts, (CN6MM) with 6MM Rack Screws, (HP-6MM). These are provided with rack, all remaining cagenuts and screws not used for mounting of equipment are to be turned over to the District. Provide one quad 20amp Electrical outlet as required for UPS Unit(s) mounted inside of rack. For placement of electrical outlet inside of rack, District will provide to contractor upon request.

b. Each IDF will consist of one wall mounted lockable door security cabinet (Mid Atlantic, DWR-24-26PD) or (Mid Atlantic SR-40-32 with PFD-40) located per Construction Documents sized per drop count and fill ratio, See 2.02 EQUIPMENT, A. Cabinets, 1. for requirements. All screws to be used for mounting of equipment into racks will be, Rack Screws, 10-32, Trim-Head, ¾ inch long with washers, (Mid-Atlantic HW100). Provide one quad Electrical outlet as required for UPS unit(s) mounted inside of rack. For placement of electrical outlet inside of rack, District will provide to contractor upon request. Rack having more than 72 drops will use the SR-40-32 rack.

c. Each building floor will have its own Intermediate Distribution Frame (IDF) located on that floor and connected back to the Main Distribution Frame (MDF) via fiber cable. No station cable will be run between floors on a building with more than one floor.

d. Middle and High School MDF equipment will be installed in the following order: Top of rack, leave one U open, then Fiber Optic Patch Panel, ensure panel is able to open correctly, One open U, next are the cooper Patch Panels, with one wire management installed below each patch panel, the switch equipment will be installed into the bottom of the rack, above the Core Switch, Core switch will have 3 U's below it, leave 1 U between the switches and the core unit. Ensure rails are positioned so that the door when closed does not press against cabling in front of cabinet or switches.

e. Elementary MDF equipment will be installed in the following order: Top of rack, leave one U open, then Fiber Optic Patch Panel, ensure panel is able to open correctly, One open U, next are the cooper Patch Panels, with one wire management installed below each patch panel, the switch equipment will be installed into the bottom of the rack, above the Core Switch, Core switch will be installed above the UPS unit, leave 1 U between the UPS unit, leave 1 U between switches and the core unit. Ensure rails are positioned so that door when closed does not press against cabling in front of cabinet or switches.

f. IDF equipment will be installed in the following order: Top of rack, Fiber Optic Patch Panel, ensure panel is able to open correctly, One open U, next are the cooper Patch Panels, with one wire management installed below each patch panel. The switch equipment, 1 U above the Power Strip, Power Strip is installed one U above the UPS unit., the UPS is to be installed into the bottom of the rack with the control unit on the top, ensure there is room at the bottom to remove the external battery without having to remove the control unit. Ensure rails are positioned so that door when closed does not press against cabling in front or back of cabinet or switches.

g. Provided Battery Backup units for MDF to be mounted in the separate 4 post rack, due to number of attached external batteries (Tripp-Lite)

h. Provide Battery Backup units for IDF to be mounted in each IDF Cabinet (Tripp-Lite), one unit will support two switches, thus if more than two switches in IDF Cabinet then one complete unit for each two switches.

i. Provide Service Loop with workstation cabling inside of IDF rack from conduits entering top or bottom of rack to opposite end of rack before going back up or down to the Patch Panel for termination. Use Velcro straps (Panduit TAK-TY Cable Ties, HLS type) to secure cabling into a bundle no more than 10 inches apart and securing to rack. Install in accordance with the latest EIA installation standards.

j. Provide a Service Loop with workstation cabling on the side of the MDF rack from conduit or ladder rack entering at top rear of the rack, down the side with the loop 2/3 of the height of the rack and back up to the patch panel for termination. Use Velcro straps (Panduit TAK-TY Cable Ties, HLS Type) to secure cabling in a bundle no more than 10 inches apart and to the rack sides. Install in accordance with the latest EIA installation standards.

k. Provide a minimum of two service loops with workstation cabling inside of each pull box between the workstation outlet location and the MDF/IDF location.

l. Rack mounted Category 5e or Category 6 patch panels (Ortronics), wire management (Ortronics) and electronics (See Data Products section)

m. Ladder racking (Chatsworth Cable Runway) will be used to transition from the conduits entering the MDF room to the MDF cabinets (locations using the free standing cabinets only)

n. Active equipment shall be configured, labeled and installed to support multiple networks, Vlans, VOIP and with IP addressing and configuration file provided by District

o. Active equipment labeling will consist of the switch name and the switch IP address, placed on the back of the switch. Verify label layout and position on switch with District.

p. IDF Racks will be labeled, each new IDF rack will be labeled in the lower right hand corner of the front door, using four (4) inch vinyl letters, White in color, from McMaster Carr Supply Co. Verify the label designation with District prior to applying.

q. Rack Dressing, appearance is everything, thus it is the Contractors responsibility to ensure that all patch cords shall be appropriate lengths and professionally dress cables to the sides of the cabinet, using wire management and Velcro straps (Ortronics or Panduit TAK-TY Cable Ties, HLS type) on patch cords as necessary. Use D ring cable management as needed to accommodate the cable bend radius. See Equipment Section for this part. Use 3 and 5 foot cables as needed. Patch Panel port should match the switch port, i.e. – 1 to 1, 2 to 2, 3 to 3 and so on.

r. Above mentioned shall be provided by the contractor unless otherwise directed by the District

4. VOIP Phone Configuration

a. Polycom VOIP Phones shall be configured per District supplied Dial Plan, or turned over to the District for installation, District will determine.

b. Polycom VOIP Phones shall be configured on the District Hosted service per Jive Communications, Inc. configuration standards using District supplied Dial Plan and completed by contractor.

5. Cisco Wireless Access Point Configuration

a. Cisco Access Points are to be configured by the Contractor onto the District WISM2 Controller.

b. Cisco Access Points are to be configured for Flex Connect, with Native Vlan 16, with Vlan Mappings for the following SSID's, PUSD – 12, PUSD_Guest – 24, STAFF – 28, STUDENT – 32, and set AP Group per district direction.

c. Contractor is required to configure the Cisco Switch port for the Access Point on Switchport Access Vlan 16, set description to LWAP

d. Cisco Access Point are to be Labeled with P-Touch Labels 1/2 inch X 4 inch, placed above the Cisco Logo on the AP, with the following information, AP Group Name,-AP #-AP-Location(RM#)-Model Number-Count per location, sample – 002All-AP99-Rm.208-2602i-1. Ask District for AP number, starting number.

6. Cisco Switch Configuration

a. Cisco Switches and Router equipment are to be configured by the Contractor per District requirements.

b. Cisco Router is to be configured with District provided configuration file and or District provided requirements.

c. Cisco Switches are to be configured with District provided configuration file or files and or District provided requirements.

d. Cisco Switch Port Vlans are to be created by Contractor onto switch ports as directed by District.

e. District staff will verify correctness of installed configuration files on Cisco Switches and Router.

f. Contractor will make any and all corrections as required and directed by District to the switch configuration.

7. Cisco Switch Installation

a. Cisco Switches are to be installed per the attached Addendum 1 Rack Layouts.

3.04 LABELING AND MARKING

A. Contractor shall complete Cable Location Chart and mount it near distribution panel in each wiring closet.

B. Contractor shall mark all distribution panels, cables and cover plates with computer-generated labels. Each drop shall be labeled with the same identifier on the receptacle faceplate, inside the junction box, on the cable at the jack, on the cable at the patch panel, on the termination side of the patch panel and on the patch side of the patch panel. Cable markers shall be located within 2” of the end of the cable jacket and shall be directly readable. Panel labels shall be computers generated and printed by a laser jet printer. Use the appropriate label forms for jack plate or insert labels as required.

C. Contractor is required to Label the MDF/IDF patch panels with the following scheme. Use a P-Touch label ½ inch wide by required length to match the label area on the Patch Panel. In line one the labels is to be the Room Number, i.e. A101, centered, on line two is to be the Patch Panel Port number. Patch Panel ports are numbered consecutively, starting with 1 and counting up to the last port.

D. Contractor is required to Label the Outlet Locations with the following scheme. Use a P-Touch label ½ inch wide by required length to fit into the Faceplate Label area. The Label is required to have the IDF designation, i.e. A1, B2, CC1, followed by a dash, then the

Room Number, followed by a dash, then the Patch Panel Port number, (example – A3-B203-115).

E. MDF and IDF Racks will be Labeled, each IDF rack will be labeled in the lower right hand corner of the front door, using four (4) inch vinyl letters, White in color, from McMaster Carr Supply Co. Verify the label designation with the District prior to ordering or applying.

F. Each Cisco Switches will be Labeled as follows: A P-Touch label ½ inch wide by 1 ½ to 2 inch in length. In line one of the labels is to be the switch name, centered, as it is in the configuration, line two is to be the switch IP address, centered.

G. Labeling and marking shall be done as per latest ANSI/TIA 606B Standards.

3.05 CABLE SYSTEM GROUNDING

A. Contractor shall bond # 6 green ground wire to all MDF/IDF distribution rack, and bond rack to grounding rods located in nearest Signal Manhole/Vault for ground continuity. Continuity shall be checked with an ohmmeter between adjacent components. Contractor shall certify to the District that ohmmeter readings are no greater than one ohm.

B. All MDF/IDF Equipment racks shall be grounded to nearest Signal Manhole/Vault with a 10 ft Cooper ground rod installed through the corner of the Manhole/Vault. Leave 10 inches above floor of Manhole/Vault to allow for the attachment of the ground cable to the ground rod.

3.06 OUTLETS AND DROPS

A. All individual workstation cable drops shall be terminated into faceplate with data connectors.

B. All cables from overhead raceways shall be neatly dressed behind distribution panels to provide adequate working space in back of panels.

C. Contractor shall terminate data pairs of each cable on distribution panels with design specified connectors.

3.07 CERTIFICATION, TESTING AND DOCUMENTATION

A. Before the Contract is considered complete, Contractor shall demonstrate performance of system in presence of the District Inspector. In the event that any of the installation is found not to be compliant to the District Specification the contractor will be required to rectify these inconsistencies to the satisfaction of the District's Inspector. This will be done at the vendor/contractor's expense.

B. "System Cut Over" shall be defined as the day the horizontal cables, cross-connect hardware, cable distribution system, labeling systems, and any other component supplied as a result of this document are installed and capable of carrying network signals as specified. The contractor shall be responsible for notifying the District of the date that the Structured Cabling System is completed and ready to be inspected before being placed into active service. (This notification shall be on the contractor's letterhead and addressed to the individuals as specified in this document) The District and the Contractor shall mutually agree upon the exact date of Inspection and System Cut Over.

C. The System Performance Period shall be thirty (30) consecutive days and shall start on the day of System Cut Over for each site.

D. Unshielded Twisted Pair Cabling

1. Unshielded twisted pair cables shall be tested for compliance with Category 5E or Category 6 Performance Standards, in accordance with ANSI/TIA-568 series industry standard and nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements.

2. Testing of unshielded twisted pair cabling will be done only with Ortronics Approved Tester (Fluke DSX-5000).

   a. Testers are required to have been factory calibrated annually, within the calibration period recommended by the manufacturer, typically 12 months. Provide a copy of the certificate of last calibration with Submittals.

   b. Ensure that software version is up-to-date.

   c. Test cords are in good shape and have not exceeded the number of test allowed. If visibly worn replace before start of testing.

   d. Ensure the correct personality module is installed for accurate results.

   e. Ensure the following are correctly set, time and date, the client's name and project name, District will provide Project Name.

   f. Permanent Link test results including the individual frequency measurements from the tester shall be recorded in the test instrument upon completion of each test for subsequent uploading to Linkware Live in which the documentation (reports) will be generated.

   g. Testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.

   h. Measurement will be provided for the following:

      1) Wiremap

      2) Length

      3) Propagation Delay

      4) Delay Skew

      5) DC Loop Resistance

      6) DC Resistance Unbalance

      7) Insertion Loss

      8) NEXT (Near-End-Crosstalk)

      9) PS NEXT (Power Sum Near-End Crosstalk)

10) ACR-N (Attenuation to Crosstalk Ratio Near-END)

11) PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)

12) ACR-F (Attenuation to Crosstalk Ratio Far-End)

13) PS-ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)

14) Return Loss

15) TCL (Transverse Conversion Loss)

16) ELTCTL (Equal Level Transverse Conversion Transfer Loss)

17) Time Domain Reflectometer

18) Time Domain Xtalk Analyzer

i. See Specification Section 27 17 10 for more detailed requirements for Testing of Balanced Twisted Pair Infrastructure. Contractor to ensure all cabling meets the testing requirements.

E. Fiber Optic Cable Testing

1. Preinstallation Testing

a. Test each strand of every optical fiber cable on the reel with a light source and a power meter. Obtain the cable manufacturer power meter test results for each reel used on the project. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.

2. Acceptance Testing

a. Upon completion of the construction and terminations, the Contractor shall perform two OTDR tests using Fluke OptiFiber Pro OTDR on every fiber and shall supply to the District the original trace taken from the OTDR. Also use the Fluke DSX-5000 for Detail of the loss, distance, date and time, OTDR operators name, cable, buffer tube color and fiber color shall be made part of the record documents. For multimode fiber, each fiber shall be tested at 850nm and 1300nm. For single mode fiber, each fiber shall be tested at 1310nm and 1550nm.

b. Testing shall be conducted in both directions (forward and rearward) and with the light sources operating at 850 and 1300 nanometers for multimode and 1310 and 1550 for single mode. The Contractor shall provide the District with certified verification of the light sources and optical power meters' calibration dates, which must be within the manufacturer's calibration interval. The Contractor shall use the following procedure to perform these tests and shall record all measured data on the End-To-End (ETE) Loss Record.

F. The Contractor shall give the District Network personnel five (5) working day's notice of all fiber optic cable testing dates so that representatives may be present if so elected.

G. In the event of failures, malfunctions, or discoveries of improper materials or installation methods during Inspection or the System Performance Period, the contractor shall be wholly responsible for taking all steps necessary to remedy the problems and/or bring the system into compliance with the specifications in this document. All remedies must be completed no later than five (5) days prior to the end of the System Performance Period. The District Inspector may order any changes, adjustments, or further tests deemed necessary to assure that systems are complete and operational in accordance with this Specification.

1. If the District is satisfied with the contractor's remedy, the contractor, at the discretion of the District, may be permitted to continue, the System Performance Period's thirty (30) consecutive day requirement as if no interruption had occurred. If the District is not satisfied with the contractor's remedy, the thirty (30) consecutive day period described herein shall start over.

2. If during the System Performance Period, the District discovers that the contractor has utilized improper materials or improper installation methods for the system, and the contractor is unable or unwilling to remedy such discoveries no later than the final day of the System Performance Period, the District reserves the right to find the contractor in default.

    a. Improper, shall be defined as any characteristic about a system component or installation method, which does not conform to the specification, outlined in this document.

3. Upon completion of a successful System Performance Period and Systems' performance is satisfactory, a Final System Acceptance will be given to the Contractor.

H. Contractor shall provide all tests and reception gear required to prove performance, as outlined, and all costs of test and documentation will be borne by Contractor.

I. Contractor shall make a final test of all cable runs between wall faceplate and distribution panel
(s). All cabling and backbones will be tested. Tests shall be made as outlined by industry accepted methods.

J. All test information shall be recorded on Cable Test Form(s) and uploaded to the District Linkware Live web site. At completion of project, these forms and any TDR or OTDR printouts will be given to the District.

K. The network switches shall be installed and tested by factory trained and certified technicians. Fundamental connectivity must be demonstrated by performing and documenting a link integrity test from each Intermediate and Workgroup switch and the Backbone switch. This testing shall consist of a ping test being conducted from a device, a random port on each switch in the network. Unsuccessful ping tests must be diagnosed and rectified resulting in a successful ping test. The completion of these tests must be documented and submitted in spreadsheet form identifying the closet and rack location of each switch along with the test results for that switch.

L. As-Builts

1. Cad Drawings, AutoCad v2009

a. A complete set of Building Drawings, preferably “as built”, will be provided in AutoCad v2009 (DWG) format or higher. The CAD Drawings will be a complete set and contain the final issue of all drawings issued during the project along with any x-reference or reference files, base files and title blocks that are needed to display the whole drawing. Drawings are to include all work accomplished by the contractor to install current system. Disciplines typically covered but not limited to, will be, Data Network Wiring Systems, Public Address/Master Clock Systems, and Security System, etc.

b. The Cad drawings will be AutoCad v2009 (DWG) format or higher. They will be delivered on CD/DVD or other electronic medium.

c. All drawings are expected to be delivered no later than 14 days after Practical Completion as defined on the Schedule.

d. The Contractor will be responsible for the delivery of the CAD drawing information and will collect all relevant CAD files together from all participants involved.

3.08 COMPLETION

A. Contractor’s work shall be considered complete after the following have been accomplished:

1. All system testing has been completed, Contractor certifies that entire system is in working order, and Cable Test Forms have been submitted to the District.

2. All ceiling panels previously removed have been put back in place.

3. All system labels have been put in place.

4. All testing results have been turned over to the District

5. All construction debris and scrap materials have been removed from project site.

6. All marked up, project record documents have been returned to the Architect or District.

7. All unused customer material has been returned to the District.

8. The District’s Inspector has inspected and accepted the installation.

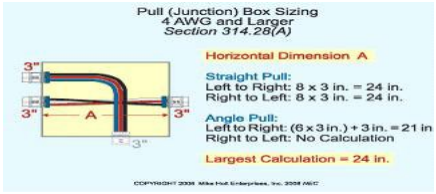
9. All As-Built documentation has been submitted to the District.

10. All Warranty documentation has been submitted to the District.

END OF SECTION

Addendum 1 Communications Pathways
General Notes
And
Premises Cable Conduit Fill Quick Reference

1. ONDUITS SHALL, (a) CONTAIN NO CONTINUOUS SECTIONS LONGER THAN 30M
2. CONDUITS SHALL CONTAIN PLASTIC OR NYLON PULL TAPE RATED AT 200 LBS. WITH A MINIMUM OF 5 FEET OF EXTRA PULL TAPE COILED AT EACH END.
3. CONDUIT BEND RADIUS SHALL BE (a) A MINIMUM OF 6 TIMES THE INTERNAL CONDUIT DIAMETER FOR CONDUITS 2" IN DIAMETER OR LESS AND, (b) 10 TIMES THE INTERNAL CONDUIT DIAMETER FOR CONDUITS MORE THAT 2" IN DIAMETER.
4. TERMINATE CONDUITS AND SLEEVES THAT PROTRUDE THROUGH STRUCTURAL FLOORS 2' - 3' ABOVE THE FLOOR SURFACE.
5. INSTALL BUSHINGS AND BELL ENDS AS REQUIRED ON ALL CONDUITS.
6. FLEX CONDUIT IS UNACCEPTABLE FOR USE AS A COMMUNICATIONS CONDUIT. AT SEISMIC JOINTS THE USE OF SEAL TIGHT CONDUIT WILL ONLY BE ACCEPTABLE.
7. ALL UNDER SLAB OR IN-SLAB CONDUITS SHALL BE INSTALLED IN A MANNER THAT PREVENTS WATER INFILTRATION OF THE CONDUIT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE GROUND WATER, RAIN WATER OR CONSTRUCTION WATER IS PREVENTED FROM ENTERING AND/OR REMOVED FROM THE CONDUITS
8. ALL PULLBOXES SHALL BE SIZED AND INSTALLED PER ANSI/TIA/EIA-569B. PULLBOXES FOR UNDER FLOOR CONDUITS RUNS ARE NOT PERMITTED UNLESS OTHERWISE NOTED. PULLBOXES FOR OVERHEAD CONDUIT RUNS SHALL BE LOCATED ABOVE ACCESSIBLE CEILINGS WITHIN THE ACCESSIBLE CEILING SPACE AND SUPPORTED INDEPENDENTLY



FOR OTHER CONDUIT SIZES REFER TO ANSI/TIA/EIA 569B TABLE 12 – LATEST PUBLISHED EDITION

9. CONDUIT(S) SHALL EXIT A PULLBOX ON THE WALL OPPOSTIE THE WALL ENTERED.
10. PROVIDE LABELING OF EACH CONDUIT PER GENERAL ELECTRICAL SPECIFICATIONS.
11. PROVIDE INTERNAL/EXTERNAL GAS AND WATER TIGHT MECHANICAL SEALING/PLUGGING OF EACH BUILDING ENTRY CONDUIT AS SPECIFIED ELSEWHERE IN THE DRAWINGS AND SPECIFICATIONS.
12. CONTRACTOR SHALL PROVIDE ALL REQUIRED LOW VOLTAGE CONDUIT SLEEVES THROUGH IDF ROOM WALLS, FIRE AND SOUND RATED WALLS, AND ALL OTHER WALLS AS REQUIRED.
13. CONTACTOR SHALL FIRESTOP ALL FIRE RATED WALL PENETRATIONS PER NEC, CEC, AND TIS/EIA REQUIREMENTS.
14. CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES TO PROTECT EXISTING PIPELINES AND UTILITIES THAT ARE TO REMAIN IN SERVICE. CONTRACTOR SHALL VERIFY THAT THOSE PIPELINES AND UTILITIES TO BE REMOVED HAVE BEEN DISCONNECTED, SHUT DOWN OR ABANDONED PRIOR TO ATTEMPTING REMOVAL OR DEMOLITION IN A MANNER TO AVOID ANY DISRUPTION OF EXISTING FACILITIES.
15. ALL DAMAGE DONE TO EXISTING CONSTRUCTION AS A RESULT OF DEMOLITION OR INSTALLATION SHALL BE COMPLETELY REPAIRED BY CONTRACTOR AT NO COST TO OWNER, REPAIRED WORK SHALL MATCH EXISTING CONSTRUCTION.
16. ALL WALL PENETRATIONS ARE TO BE FIRE CAULKED AND SEALED PER THE 1995 CALIFORNIA FIRE CODE.

Premises Cable Conduit Fill Quick Reference

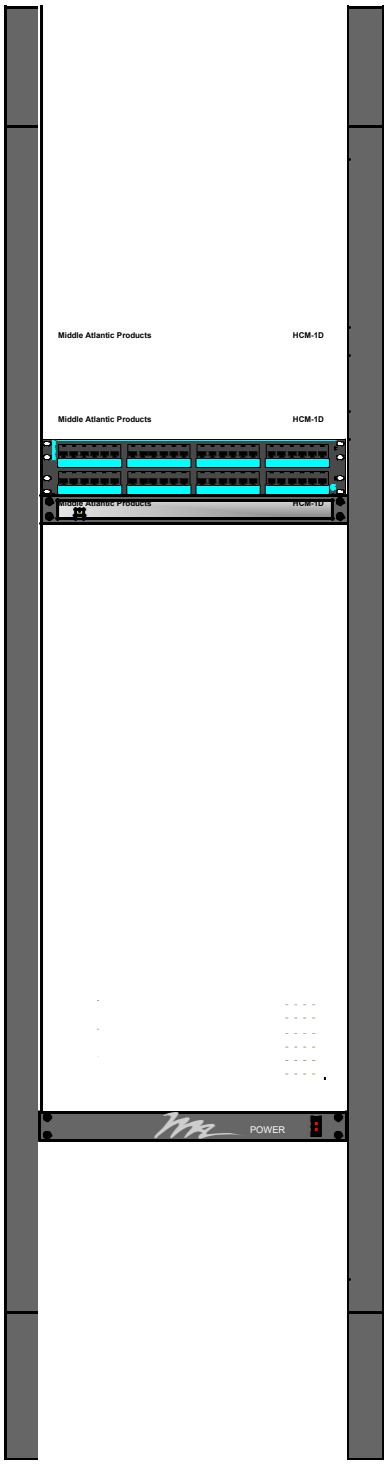
This information is intended as a guideline. Because conduit sizes may vary by manufacturer, please verify all dimensions prior to using this reference chart. This guideline is based on National Electrical Code (USA) recommendations for conduit fill of runs with no more than two 90° bends. For assistance in calculating conduit fill, refer to the "Resources" area of our site for the Technical Guideline, "How to Calculate Conduit Fill." Use only approved lubricants.

Conduit Trade Size Designator* English (Metric)	½ (16)	¾ (21)	1 (27)	1¼ (35)	1½ (41)	2 (53)	2½ (63)	3 (78)	3½ (91)	4 (103)	5 (129)
Conduit Internal Diameter in (mm)	0.62 (15.7)	0.82 (20.9)	1.05 (26.6)	1.38 (35.1)	1.61 (40.9)	2.07 (52.5)	2.47 (62.7)	3.07 (77.9)	3.55 (90.1)	4.03 (102.3)	5.05 (128.2)
Conduit Cross-Sectional Area in² (mm²)	0.30 (195)	0.53 (345)	0.87 (559)	1.51 (973)	2.05 (1,322)	3.39 (2,177)	482 (3,106)	7.45 (4,794)	9.96 (6,413)	12.83 (8,268)	20.15 (12,984)
Cable Nominal Diameter in (mm)	Number of Cables at Maximum Recommended Conduit Fill (1 Cable @ 53% Maximum, 2 Cables @ 31% Maximum, 3 or More Cables @ 40% Maximum)										
0.10 (2.5)	15	26	44	76	103	171	262	376	504	649	1020
0.13 (3.3)	9	15	26	45	61	101	155	223	298	384	603
0.15 (3.8)	6	11	19	33	46	76	116	167	224	288	453
0.18 (4.6)	4	8	13	23	32	52	80	116	155	200	314
0.20 (5.1)	3	6	11	19	25	42	65	94	126	162	255
0.21 (5.3)	3	6	10	17	23	38	59	85	114	147	231
0.22 (5.6)	3	5	9	15	21	35	54	77	104	134	210
0.23 (5.8)	2	5	8	14	19	32	49	71	95	122	192
0.24 (6.1)	2	4	7	13	18	29	45	65	87	112	177
0.25 (6.4)	1	4	7	12	16	27	41	60	80	103	163
0.26 (6.6)	1	3	6	11	15	25	38	55	74	96	150
0.27 (6.9)	1	3	6	10	14	23	35	51	69	89	139
0.28 (7.1)	1	3	5	9	13	21	33	48	64	82	130
0.29 (7.4)	1	3	5	9	12	20	31	44	59	77	121
0.30 (7.6)	1	2	4	8	11	19	29	41	56	72	113
0.31 (7.9)	1	2	4	7	10	17	27	39	52	67	106
0.32 (8.1)	1	2	4	7	10	16	25	36	49	63	99
0.33 (8.4)	1	1	4	6	9	15	24	34	46	59	93
0.34 (8.6)	1	1	3	6	8	14	22	32	43	56	88
0.35 (8.9)	1	1	3	6	8	13	21	30	41	53	83
0.40 (10.2)	1	1	2	4	6	10	16	23	31	40	63
0.45 (11.4)	1	1	1	3	5	8	12	18	24	32	50
0.50 (12.7)	0	1	1	3	4	6	10	15	20	25	40
0.55 (14.0)	0	1	1	1	3	5	8	12	16	21	33
0.60 (15.2)	0	0	1	1	2	4	7	10	14	18	28
0.65 (16.5)	0	0	1	1	1	4	6	8	11	15	24
0.70 (17.8)	0	0	1	1	1	3	5	7	10	13	20
0.75 (19.1)	0	0	1	1	1	3	4	6	8	11	18
0.80 (20.3)	0	0	0	1	1	2	4	5	7	10	15
0.85 (21.6)	0	0	0	1	1	1	3	5	6	8	14
0.90 (22.9)	0	0	0	1	1	1	3	4	6	8	12
0.95 (24.1)	0	0	0	1	1	1	2	4	5	7	11
1.00 (25.4)	0	0	0	1	1	1	2	3	5	6	10

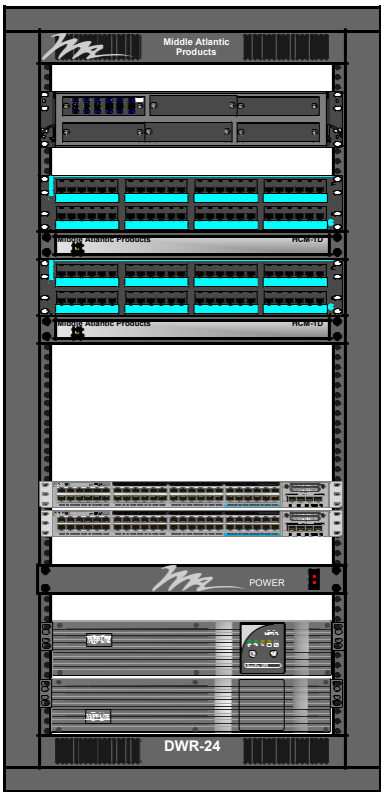
**Identifier only; not an actual dimension*

Addendum 2 Rack Layouts

Middle Altantic
SR-40-32
Rack Layout



Middle Altantic
DWR-24-26PD
Rack Layout



SECTION 27 5126

ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide a complete Assistive Listening System of broadcasting audio in the assembly area including classroom.

1. Provide a personal FM transmitter and microphone for the speaker or teacher. Transmitter shall be capable of being clipped to a pocket or belt.

2. Provide at a minimum number of personal FM receivers and headsets greater than or equal to 4% of the total number of seats in the assembly area or classroom. Receiver shall be capable of being clipped to a pocket or belt.

3. Provide at a minimum 25% of the number of receivers but no fewer than two that are hearing aid compatible per CBC 11B-706.3

B. Related Requirements:

1. Division 01 - General Requirements.

1.02 SUBMITTALS

A. Provide the following submittals:

1. Catalog cuts, technical data, and descriptive literature on components. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data.

1.03 CODES AND STANDARDS

A. Complete installation shall meet or exceed the latest edition of the following standards:

1. CBC 11B-706.

1.04 SYSTEM DESCRIPTION

A. The system shall be complete including transmitter, microphone, receivers, earphones, hearing aid compatible neckloops, batteries, and charging devices.

B. The system shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.

C. The signal-to-noise ratio for internally generated noise shall be 18 dB minimum.

D. Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

1.05 QUALITY ASSURANCE

A. All devices shall comply with applicable standards of the Underwriter's Laboratories, Inc.

1.06 WARRANTY

A. The manufacturer shall guarantee the system and components against defective products for a period of one year.

PART 2 - PRODUCTS

2.01 PERSONAL FM TRANSMITTER

A. Telex PST-170 or equal.

2.02 PERSONAL FM RECEIVER

A. Telex SR-50 or equal.

B. Receiver shall include a 1/8" mono jack.

C. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.

2.03 HEARING AID COMPATIBLE NECKLOOP

A. Telex NL-4S or equal.

2.04 BATTERIES:

A. Provide batteries for all devices per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 WALL SIGN

A. Provide sign with wording that states "Assistive-Listening System Available" per CBC 11B-216.10 at or near the entrance. Sign shall comply with CBC 11B-703.5 and shall include the International Symbol of Access for Hearing Loss per CBC 11B-703.7.2.4.

END OF SECTION

SECTION 31 00 10

SITE WORK

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Work including but not limited to the following:

1. Excavate, backfill, compact, and grade site to elevations shown on the drawings, as specified herein, and as needed to meet requirements of construction shown.

B. Related work described elsewhere:

1. Cast-in-place Concrete -- Section 03 30 00

1.02 Quality Assurance:

A. Perform work of this Section in strict accordance with applicable requirements of the governmental agencies which have jurisdiction and under direction of Project Engineer.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of work specified in this Section.

C. Use equipment adequate in size, capacity, and numbers to accomplish work in a timely manner.

1.03 Job Condition:

A. Utilities:

1. Before starting work, coordinate work and obtain clearance from utility companies and/or governmental agencies which supply existing or proposed services to project.

2. Unless they are shown to be removed, protect active utility lines prior to excavating. If damaged, repair or replace such utility lines at no additional cost to Owner.

3. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to Contractor, take necessary steps promptly to assure that service will not be interrupted.

4. If service is interrupted by work performed under this Section, immediately restore service by repairing damaged utility at no additional cost to Owner.

5. If existing utilities interfere with permanent facilities being constructed under this Contract, immediately notify Architect and obtain instructions. Do not proceed with permanent relocation of utilities until written instructions from Architect is received.

6. Contractor shall accept the site as it presently exists in its present condition, and he shall be required to perform all necessary excavation, backfill, provide fill material if required, remove surplus earth if any, etc., and no claim for additional compensation on account of excess excavation, excess surplus earth, etc., shall be made by the contractor.

B. Protection of persons and property:

1. Barricade all open depressions and holes which occur in the performance of this work.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.

C. De-watering:

1. Remove all water, including rainwater, encountered during trenching and sub-structure work to an approved location by pumps, drains, and other approved methods.

2. Keep excavations and site construction area free from water.

D. Dust Control:

1. Control dust on and near work (including on and near off-site), if such dust is caused, or resulted, by Contractor's operations during or after performance of work.

2. Thoroughly moisten surfaces as necessary to prevent dust from being a nuisance to adjacent properties, general public, and personnel performing work on site.

E. Maintain access to adjacent areas at all times.

PART 2 - PRODUCTS

2.01 Materials:

A. Fill and backfill materials:

1. Provide grading materials free from organic matter and deleterious substances, which contain no rocks, or lumps more than 4" in greatest dimension. Not more than 15% of rocks or lumps shall be larger than 2-3/8" in greatest dimension.

2. Fill material is that material removed from excavations or imported from off-site borrow areas. It shall be inorganic granular, non-expansive soil, free from roots and other deleterious matter.

3. All rough grading material shall be free of rocks larger than three inches within the top 2 feet of any fill. All finish grading material shall be free of rocks larger than 1 inch. Excavation materials taken from this job site as part of this work may be used as grading material, providing it satisfies the above requirements of the preceding sentence.

4. Cohesionless material used for structural backfill: Use sand which is free from organic material and other foreign matter, as approved by Engineer.

2.02 Weed Killer:

A. Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting vegetation growth, and approved for use in this work by local governing agencies which have jurisdiction in such matters.

PART 3 - EXECUTION

3.01 Inspection:

A. Examine areas and conditions under which work of this Section is performed. Correct conditions which are detrimental to timely and proper completion of work before proceeding.

3.02 Finish Elevations and Lines:

A. Carefully preserve all data and monuments set by Surveyor. If displaced or lost, have them replaced immediately at no additional cost to Owner.

3.03 Excavating:

A. Excavate every type of material encountered within limits of Work to lines, grades, and elevations indicated and as specified herein.

B. Excavated materials satisfactory for fill: Transport to, and place in, fill or embankment areas within limits of Work.

C. Excavated materials unsatisfactory for fill:

1. Excavate to a distance below grade as required and replace with satisfactory materials.

2. Include excavation of unsatisfactory fill materials and replacement with satisfactory fill materials as parts of work of this Section.

3. Dispose of excavated material which is unsatisfactory for fill away from Site at disposal sites arranged and paid for by Contractor.

D. Excavation of rock:

1. Where rocks, boulders, granite, or similar material is encountered, and where such material cannot be removed or excavated by conventional earth-moving or ripping equipment, take necessary steps to proceed with general grading operations of Work. Remove or excavate such material by means which will neither cause additional cost to Owner nor endanger buildings or structures, on or off job site.

2. Do not use explosives.

E. Excavate and backfill in a manner and sequence which will provide proper drainage at all times.

F. Ditches and gutters:

1. Cut accurately to cross sections, grades, and elevations shown.

2. Maintain excavations free from detrimental quantities of leaves, sticks, trash, and other debris, until completion of Work.

3. Dispose of excavated materials as shown on drawings.

G. Unauthorized excavation:

1. Unauthorized excavation is defined here as removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect.

2. Under footings, foundation bases, or retaining walls: Fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.

3. Backfill and compact unauthorized excavations elsewhere, as specified for authorized excavations.

H. Stability of excavations:

1. Slope sides of excavations to 1:1 or flatter, unless otherwise directed by Civil Engineer.

2. Shore and brace where sloping is not possible because of space restrictions or stability of materials being excavated.

3. Maintain sides and slopes of excavations in a safe condition until backfilling has been completed.

I. Shoring and bracing:

1. Provide materials for shoring and bracing, as necessary for safety of personnel and protection of property which might occur as a result of the collapse of excavations, and compliance with requirements of all governmental agencies which have jurisdiction.

2. Maintain shoring and bracing in excavations, regardless of time period that excavations will be open.

3. Carry shoring and bracing downward as excavation progresses.

3.04 Filling and Backfilling:

A. Backfill excavations as promptly as progress of Work permits, but not until:

1. Acceptance of construction below finish grade;

2. Inspection, testing, approval, and recording locations of underground utilities;

3. Removal of concrete formwork;

4. Removal of shoring and bracing and backfilling voids with satisfactory materials;

5. Removal of trash and debris; and

6. Horizontal bracing is in place on horizontally supported walls.

B. Ground surface preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

2. Plow, strip, or break up surfaces which are steeper than one vertical to four horizontals, so that fill material will bond with existing surface.

3. When existing ground surface has density less than that specified under "3.06 Compacting" for a particular area, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

4. Scarify exposed soils in areas to be paved to a minimum depth of 6" and recompact at a moisture content which will permit proper compaction as specified for fill.

C. Placing and compacting:

1. Place backfill and fill materials in layers which are not more than 8" in loose depth.

2. Before compacting, moisten or aerate each layer as necessary to provide optimum moisture content.

3. Compact each layer to required percentage of maximum density of the area.

4. Do not place backfill or fill material on surfaces which are muddy, frozen, or which contain frost or ice.

5. Place backfill and fill materials to required elevations, evenly adjacent to structures.

6. Take care to prevent wedging action of backfill against structures. Carry material uniformly around structure to approximate same elevation in each lift.

D. Utility Backfill:

1. Bottoms of trenches to be cut to grade, and bell holes shall be excavated to ensure the pipes bearing for the entire length upon the outside periphery of the lower third of the pipe.

2. Provide three inches of sand bedding before laying pipe or duct.

3. Shade pipe with 6" sand and backfill with approved on-site material.

4. Compact all new & existing fill as required by this section.

3.05 Grading:

A. General:

1. Grade areas uniformly within limits of grading under this Section, including adjacent transition areas.

2. Smooth finished surfaces within specified tolerances.

3. Compact with uniform levels or slopes between points where elevations are shown on Drawings, or between such points and existing grades.

4. Where a change of slope is indicated on Drawings, construct a rolled transition section which has a minimum radius of approximately 8'-0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

B. Grading Tolerances:

1. Grade areas adjacent to buildings to achieve drainage away from structures and to prevent ponding.

2. Finish surfaces to be free from irregular surface changes and:

(a) Walks: Shape surface of areas scheduled to be under walks to line, grade, and cross-section. Finished surface shall not be more than 0.10 foot above or below required subgrade elevation.

(b) Pavements: Shape surface of areas scheduled to be under pavement to line, grade, and cross-section. Finished surface shall not be more than 0.05 foot above or below required subgrade elevation.

(c) Landscape areas: Shape surface of areas scheduled to be landscaped to line, grade, and cross-section. Finished surface shall not be more than 0.10 foot above or below required subgrade elevation.

(d) Structures: Shape surface of areas scheduled to be beneath structures to line and grade. Finished surface shall not be more than 0.05 foot above or below required subgrade elevation.

3.06 Compacting:

A. Provide not less than the following maximum density of soil material compacted at optimum moisture content for actual density of each layer of soil material in place:

1. Structures: Compact the top 12" of subgrade and each layer of fill material of backfill material at 92% of maximum dry density unless required otherwise.

2. Lawn and unpaved areas:

(a) Compact the top 8" of subgrade and each layer of fill material or backfill material at 90% of maximum dry density;

(b) Compact the upper 12" of filled areas, or natural soils exposed by excavating, at 90% of maximum dry density;

3. Walks: Compact the top 8" of subgrade and each layer of fill material or backfill material at 92% of maximum dry density;

4. Pavements: Compact the top 12" of subgrade and each layer of fill material or backfill material at 92% of maximum dry density for cohesive soil material.

B. Moisture Control:

1. Where subgrade or layer of soil material must be moisture-conditioned before compacting, apply water uniformly to surface of subgrade or layer of soil material to prevent free water from appearing on surface during or after compacting operations.

2. Remove and replace, or scarify and air-dry, soil material that is too wet to permit compacting to specified density.

3. Soil material which has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture-density relation tests have been approved by Architect.

3.07 Field Quality Control:

A. Provide at least the following tests, unless specified otherwise:

1. At paved areas: at least one field density test for each 2,000 sq. ft. of paved area; but not less than two tests;

2. In each compacted fill layer: one field density test for each 2,000 sq. ft. of overlaying paved area; but not less than two tests.

B. If, in Architect's opinion, subgrade or fills which have been placed are below specified density, additional compacting and testing shall be performed, as required, at no additional cost to Owner.

3.08 Maintenance:

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion and keep free from trash and weeds.

2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning compacted areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density, prior to further construction.

3.09 Certification:

A. Upon completion of this portion of Work, and as a condition of its acceptance, deliver to a written report from certifying that compaction requirements have been met. State in report: area of fill or embankment; compaction density obtained; and type or classification of fill material placed.

END OF SECTION

SECTION 32 31 13

CHAINLINK FENCING

THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.01 Scope:

A. Furnish and install Chainlink Fencing as shown on the drawings and as specified in this section.

1.02 Job Conditions:

A. Contractor shall accept the site as it exists in its present condition and no claim for additional compensation on account of existing site conditions encountered, shall be made by the Contractor.

1.03 Related work described elsewhere:

A. Cast-in-place Concrete – Section 03 30 00

1.04 Submittals:

A. Samples and Shop Drawings: Provide and submit for approval shop drawings and samples of components, parts and fittings as per General Conditions.

PART 2 - PRODUCTS

2.01 Materials:

A. General: Materials shall be of new stock and the best of their respective kinds meeting the following requirements. All steel parts shall be hot-dipped galvanized, per respective ASTM A123 requirements.

B. Top Rails: Tubular 1-5/8-inch O.D. galvanized copper bearing hot-dipped steel and shall be continuous from corner to corner, or end to end as the case might be, with galvanized sleeve couplings meeting ASTM A123, Class 1.

C. Fence Fabric: #9-gauge steel wire 2-inch mesh galvanized after weaving in accordance with ASTM A392, Class 1. Height of fence shall be 6 feet unless indicated otherwise.

D. Hardware & Fittings: hot-dipped galvanized steel, pressed steel or malleable wrought iron. ASTM A153. Unless noted otherwise, all other chain link fence articles shall meet ASTM A121 requirement.

E. Tension Wire: Install one #7 coil spring tension wire at base of fabric, ASTM A392. Install the tension wire with one turnbuckle securely fastened to corner, end or gate posts and fasten to the fabric

with #16 galvanized wire not to exceed 24 inches on center. Twisted fasteners shall be on the outside of fabric or posts.

F. Fabric Fasteners: Fasten to intermediate posts with bands of preformed wires or bands at centers not to exceed 18 inches. Fasten fabric to top rail and box brace members with preformed wire at intervals not to exceed 18 inches on centers. Fasten to all terminal posts, corner or gate posts with preformed bands and tension bars of not less than 3/16" X 3/4" high carbon steel securely bolted, spaced not to exceed 18 inches on center and as recommended by factory. ASTM A123.

2.02 Gates:

A. Fabricate gates of 2-inch O.D. Hot-dipped galvanized pipe weighing not less than 2.72 pounds per lineal foot; assemble with heavy coat corner fittings; cross bracing as required.

B. Equip hinged gates complete with malleable iron ball and socket hinges (or approved equal), catches, stops, center rests and padlock eyes.

2.03 Posts:

A. Intermediate Line Posts for fence up to and including 8 feet in height shall be tubular hot-dipped galvanized steel copper bearing pipe 2-3/8 inch O.D. weight 3.65 pounds per lineal foot with weather-proofed ornament on top to carry top rail, or line posts may be "H" column hot-dipped galvanized copper bearing steel weighing not less than 4.10 pounds per lineal foot. Line posts shall be set in 30 inches of concrete not to exceed 10 feet 2 inches on center.

B. Corner, End or Gate posts for fence up to and including 8 feet in height shall be of hot-dipped galvanized steel copper bearing schedule 40 pipe 2-7/8 inches minimum O.D. with weather-proofed ornament on tip, set 36 inches in concrete or galvanized pipe sleeve as the case might be.

C. Gate posts for swinging gates of maximum opening of 12 feet single or 24 feet double shall be 4 inch O.D. galvanized steel pipe (minimum weight 9.1 pounds per foot); for maximum opening of 18 feet single or 36 feet double, shall be 6-5/8 inch O.D. galvanized pipe (minimum weight 18.97 pounds per foot); for openings over 18 feet single or 36 feet double, shall be 8-5/8 inch O.D. galvanized pipe (minimum weight 24.7 pounds per foot).

PART 3 - EXECUTION

3.01 Protection:

A. Preserve and protect from injury trees, poles, fences, playground equipment, utility vaults and boxes, including covers and clean-outs and restore or replace, without cost to the Owner any and all trees, poles, fences, playground equipment, shrubs and grass that may be removed or damaged in the performance of this work.

3.02 Restoration:

A. Restore without cost to the Owner, street pavement, curbs and walks that may be opened, broken or damaged in any manner in performance of this work.

B. Restore and/or replace, without cost to Owner, asphalt paving damaged during, or as a result of the installation of this work, using the same materials as specified for other asphalt paving, and to satisfaction of Owner.

3.03 Installation:

A. Install fencing, gates and fittings in accordance with these specifications and the best practices known in the trade. Where bolts and nuts are used, draw up the nuts tight.

B. If existing concrete slabs, flatwork or asphaltic concrete paving are required to be pierced, cut, or removed for the installation of this work, holes in surface shall be made in a neat, clean cut, - symmetrical fashion, and shall be saw-cut. Trowel surface of concrete placed in such holes to a smooth neat surface flush with surrounding surfaces.

C. Provide and install sheet metal closures between terminal posts and buildings as required. Fabricate sheet metal and fasteners therefor from galvanized materials.

3.04 Post Setting:

A. Set posts in concrete retaining walls, concrete slabs or concrete abutments in galvanized pipe sleeves.

B. Set posts in earth in concrete bases at least 9 inches in diameter of a mix of two parts cement, five parts sand, and six parts gravel.

C. Set line posts not less than 30 inches deep and set gate, pull, corner and terminal posts not less than 36 inches deep.

D. Sleeves for posts are to be large enough to receive the various size posts.

E. Corner, gate or end post sleeves are to be at least 24 inches long and line post sleeves are to be at least 18 inches long.

F. After posts are set, fill sleeves with a thin mixture of sand and cement level with top of sleeve.

3.05 Braces:

A. Braces to be of same material as top rail; install at mid-height of fence, extending from end, corner or gate post to first adjacent line post unless shown otherwise; secure braces to posts with suitable and approved connections. Truss from line post back to end, corner or gate post with 3/8-inch diameter galvanized steel rod.

3.06 Fabric:

A. Install fabric with knuckles at top and bottom unless indicated otherwise.

3.07 Clean-up:

A. Upon completion of the work, all excess materials resulting from installation of this work shall be cleared from the jobsite, leaving it in a clean and acceptable condition.

END OF SECTION