SPECIFICATIONS

FOR THE

RENOVATION OF THE MAINTENANCE AND OPERATIONS ADMINISTRATION FACILITY

VENTURA COMMUNITY COLLEGE

PREPARED FOR

VENTURA COUNTY COMMUNITY COLLEGE DISTRICT
255 WEST STANLEY AVENUE
VENTURA, CA 93001

Project P 0107586

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SECTION 00 10 10 – TABLE OF CONTENTS

DIVISION 1: SUMMARY OF WORK

SECTION 01 11 00: SUMMARY OF WORK

PROJECT DESCRIPTION

1. THIS PROJECT CONSISTS OF THE INTERIOR IMPROVEMENTS TO THE MAINTENANCE AND OPERATIONS ADMINISTRATION OFFICE FACILITY, 4667 TELEGRAPH ROAD, VENTURA, CA 93003; AND AS SHOWN ON CONTRACT DRAWINGS PREPARED BY ROY E. COLBERT, ARCHITECT.

2. THE SCOPE OF THIS PROJECT CONSISTS OF THE CREATION OF INTERIOR OFFICES, ENTRY LOBBY, CONFERENCE ROOM, EMPLOYEE LOUNGE, TWO (2) EMPLOYEE SHOWERS AND BRING THE EXISTING RESTROOMS INTO COMPLIANCE WITH THE DISABLED ACCESS REQUIREMENTS TO THE FULLEST EXTENT POSSIBLE FOR AN EXISTING PUBLICLY FUNDED BUILDING PER C.B.C., SECT., 11B-202.4, EXCEPTION 2.

3. THE WORK CONSISTS OF THE SELECTIVE DEMOLITION, CONSTRUCTION AND NEW INTERIOR FINISHES TO THE EXISTING FACILITY, INCLUDING HANDICAP ACCESSIBILITY, NEW RESTROOM PLUMBING FIXTURES, COUNTER TOPS, PARTITIONS AND NEW LIGHTING FIXTURES.

4. THE VENTURA COMMUNITY COLLEGE PERSONNEL WILL BE REQUIRED TO OCCUPY PORTIONS OF THE BUILDING DURING DEMOLITION AND CONSTRUCTION OPERATIONS

5. DURING CONSTRUCTION THE CONTRACTOR SHALL HAVE FULL ACCESS TO THE BUILDING. HOWEVER, DEMOLITION AND CONSTRUCTION OPERATIONS SHALL BE LIMITED TO THE PROJECT AREA SHOWN ON THE DRAWINGS. ENTRANCES AND ACCESS TO THE BUILDING ITSELF SHALL REMAIN CLEAR AT ALL TIMES FOR NORMAL PERSONNEL OCCUPANCY, FUNCTION, AND FOR USE BY THE MAINTENANCE AND OPERATIONS DEPARTMENT.

6. NOTE: THE INTENT OF THE DRAWINGS AND SPECIFICATIONS IS TO INCLUDE THE RELEVANT ITEMS NECESSARY FOR THE PROPER EXECUTION AND COMPLETION OF THE WORK BY THE CONTRACTOR. THE DRAWINGS AND SPECIFICATION ARE COMPLEMENTARY, AND WHAT INFORMATION IS ON ONE IS BINDING AS IF ON ALL. WHERE THE SPECIFICATIONS ON THE DRAWINGS DIFFER FROM THESE WRITTEN SPECIFICATIONS, THESE WRITTEN SPECIFICATIONS SHALL GOVERN AS BEING NECESSARY TO PRODUCE THE INTENDED RESULTS.

7. AT THE CONCLUSION OF THE PROJECT THE CONTRACTOR SHALL PUBLISH AND DELIVER TO VENTURA COLLEGE A COMPLETE “CLOSE OUT” RECORD DOCUMENT. THIS SHALL INCLUDE THE FOLLOWING:

A. A LISTING OF ALL THE SUB-CONTRACTORS TOGETHER WITH THEIR CONTACT INFORMATION.

B. CONTRACTOR AND SUBCONTRACTOR GUARANTEES/WARRANTIES

C. AS BUILT FLOOR PLANS WITH CONTRACTOR'S NOTES

D. INTERIOR DOOR & DOOR HARDWARE PRODUCT INFORMATION

E. INTERIOR GLAZING PRODUCT INFORMATION

F. COUNTERTOP PRODUCT INFORMATION & MAINTENANCE MANUAL

G. MILLWORK SHOP DRAWINGS AND FABRICATION SPECIFICATIONS

H. CERAMIC TILE, GROUT & MAINTENANCE MANUAL

I. SPECIALTY FLOORING PRODUCT & MAINTENANCE MANUAL

J. SUSPENDED CEILING ASSEMBLY & CEILING TILE PRODUCT INFORMATION

K. PLUMBING FIXTURES, OPERATIONS & MAINTENANCE MANUAL

L. RESTROOM PARTITIONS & ACCESSORIES PRODUCT INFORMATION

M. ELECTRIC LIGHTING FIXTURES & CONTROLS MANUAL

N. ALL HVAC/MECHANICAL SYSTEM PRODUCTS & FITTINGS INFORMATION

O. ALL FIRE SPRINKLER SYSTEM PRODUCTS & FITTINGS INFORMATION

P. PAINTING PRODUCT INFORMATION INCLUDING COLOR LOG

Q. ALL OTHER PERTINENT PRODUCT & MAINTENANCE INFORMATION

8. SCOPE OF THE PROJECT:

- PATCH, BLEND AND GRIND SMOOTH THE EXISTING CONCRETE FLOOR AND PREPARE THE FINISHED CONCRETE SUB-FLOOR SURFACE FOR THE NEW FLOOR FINISHES
- SAW CUT THE CONCRETE FLOOR SLAB TO ACCESS THE EXISTING UNDERGROUND PLUMBING LINES
- INSTALL THE NEW SUB-FLOOR PLUMBING DRAIN LINES
- BACKFILL AND INSTALL NEW CONCRETE FLOOR LABS; PATCH, BLEND AND GRIND SMOOTH THE CONCRETE REPLACEMENT FLOOR SLABS WITH REINFORCING STEEL BARS

- REMOVE AND REPLACE THE EXISTING PLUMBING FIXTURES, PARTITIONS AND ACCESSORIES
- CAP ALL PLUMBING LINES DURING CONSTRUCTION
- REMOVE AND REPLACE THE EXISTING FLOOR DRAINS WITH SELF-PRIMING DRAINS
- REMOVE AND REPLACE THE EXISTING RESTROOM WALL & FLOOR TILES
- ADD A SHOWER IN BOTH THE MEN'S AND WOMAN'S RESTROOM AREAS PER DISABLED ACCESSIBILITY REQUIREMENTS
- INSTALL NEW RESTROOM ACCESSORIES
- INSTALL NEW LIGHT GAUGE METAL-FRAMED PARTITIONS
- INSTALL THE NEW STEEL 12-GAUGE PONY WALL SUPPORTS AT THE RESTROOM LAVATORY COUNTERS
- INSTALL NEW INTERIOR DOORS IN HOLLOW METAL METAL FRAMES TO MATCH THE EXISTING DOORS
- INSTALL NEW SUSPENDED T-BAR CEILINGS THROUGHOUT
- INSTALL NEW EXHAUST FANS AT THE SHOWER AREAS
- RECONFIGURE THE EXISTING HVAC DUCTS AS REQUIRED
- REMOVE AND REPLACE THE EXISTING LIGHT FIXTURES AND SWITCHES
- INSTALL NEW LIGHTING FIXTURES THROUGHOUT
- INSTALL ADDITIONAL ELECTRIC OUTLETS AND LIGHT SWITCHES
- PATCH ALL FINISH SURFACES AND BLEND FOR A SEAMLESS SMOOTH FINISH
- PAINT ALL WALLS
- COORDINATE ALL WORK AND ACTIONS WITH THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS FOR VENTURA COLLEGE

DIVISION 02: SELECTIVE DEMOLITION

SECTION: 02 41 19: SELECTIVE DEMOLITION OF EXISTING FACILITIES

PLEASE NOTE THAT DEMOLITION MAY UNCOVER AND POSSIBLY CREATE HAZARDOUS CONDITIONS, INCLUDING BUT NOT LIMITED TO AIRBORNE ASBESTOS, LEAD, ETC. AS A RESULT SPECIAL ABATEMENT PROCEDURES MAY BE REQUIRED. THE CONTRACTOR SHALL BE ADVISED TO TAKE ALL PRUDENT MEASURES REGARDING IDENTIFICATION, TESTING AND ABATEMENT AND SHALL COMPLY WITH ALL LOCAL, STATE AND FEDERAL STATUTES.

GENERAL PROVISIONS

1. THE EXTENT OF THE SELECTIVE DEMOLITION WORK IS INDICATED ON THE DRAWINGS.
2. TYPES OF THE SELECTIVE DEMOLITION WORK SHALL INCLUDE REMOVAL OF THE PLYWOOD WALL SURFACE PANELS, SAW CUTTING CONCRETE FLOOR AREAS AT THE PROPOSED SHOWER LOCATIONS, EXISTING PLUMBING FIXTURES, EXISTING TOILET PARTITIONS AND ACCESSORIES, EXISTING LIGHTING FIXTURES AND EXISTING WALL COVERING WHERE EXISTING PLUMBING LINES ARE TO BE CAPPED AND WHERE NEW PLUMBING FIXTURES ARE TO BE INSTALLED.
3. SUBMIT A SCHEDULE FOR THE SELECTIVE DEMOLITION WORK TO THE VENTURA COUNTY COMMUNITY COLLEGE DISTRICT NOTING THE PROPOSED SEQUENCE OF OPERATIONS, AND INCLUDE COORDINATION FOR SHUT-OFF, CAPPING AND CONTINUATION OF UTILITY SERVICES, TOGETHER WITH THE DETAILS FOR DUST AND NOISE CONTROL AND ABATEMENT.
4. NOTE THAT VENTURA COLLEGE WILL BE CONTINUOUSLY OCCUPYING AREAS OF THIS BUILDING ADJACENT TO THIS PROJECT AREA. CONDUCT THE DEMOLITION WORK AND SUBSEQUENT CONSTRUCTION WORK IN A MANNER THAT WILL MINIMIZE A NEED FOR DISRUPTION OF THE COLLEGE'S NORMAL OPERATIONS. PROVIDE A MINIMUM OF 72 HOURS ADVANCE NOTICE TO THE COLLEGE OF DEMOLITION ACTIVITIES THAT MIGHT IMPACT NORMAL COLLEGE OPERATIONS.
5. QUALITY CONTROL:
   A. PROVIDE TEMPORARY BARRICADES AND OTHER FORMS OF PROTECTION TO PROTECT COLLEGE PERSONNEL AND THE GENERAL PUBLIC FROM INJURY.
   B. PROTECT FROM DAMAGE THE EXISTING ADJACENT FINISH WORK THAT IS TO REMAIN IN PLACE AND BECOMES EXPOSED DURING THE DEMOLITION OPERATIONS.
   C. CONSTRUCT TEMPORARY DUST MITIGATING ENCLOSURES OR PARTITIONS TO ENCAPSULATE THE WORK.
   D. PROMPTLY REPAIR ANY DAMAGE CAUSED TO ADJACENT AREAS AT NO COST TO THE VENTURA COUNTY COMMUNITY COLLEGE DISTRICT.

E. IF ANY UNANTICIPATED MECHANICAL, ELECTRICAL OR STRUCTURAL ELEMENTS WHICH CONFLICT WITH THE INTENDED FUNCTION OR DESIGN ARE ENCOUNTERED, SUBMIT IN WRITING A REPORT THAT CLEARLY DESCRIBES THE NATURE AND EXTENT OF THE CONFLICT.

F. IT IS UNDERSTOOD THAT SHOULD IMPACT TOOLS BE USED TO REMOVE THE EXISTING FLOOR TILES, THIS PHASE OF THE WORK MUST BE COORDINATED WITH THE FACILITIES, MAINTENANCE AND OPERATIONS DEPARTMENT FOR SPECIFIC SCHEDULING.

DEMOLITION:

1. DEMOLISH CONCRETE WHERE REQUIRED IN SMALL SECTIONS ONLY. USE POWER-DRIVEN SAWS OR HAND TOOLS. DO NOT USE POWER DRIVEN IMPACT TOOLS UNLESS APPROVAL IS GRANTED BY THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS.
2. DO NOT CRACK OR STRUCTURALLY DISTURB ADJACENT CONCRETE SLAB ON GRADE OR WALL PARTITIONS.
3. ANCHOR BOLTS THAT ARE TO BE REMOVED AT PARTITIONS TO BE REMOVED SHALL BE REMOVED TO AT LEAST 1-INCH BELOW THE SURROUNDING SURFACE, AND THE RESULTING HOLE SHALL BE PATCHED WITH CEMENT MORTAR.
4. PREPARE EXPOSED DRAIN LINE TO RECEIVE NEW SELF-PRIMING DRAIN FITTINGS WITH ½" COPPER TYPE-L WATER LINES.
5. REMOVE ALL EXISTING WALL HUNG PLUMBING FIXTURES. CAP AND/OR PLUG THE SUPPLY AND DRAIN LINES.
6. REMOVE THE EXISTING TOILET PARTITIONS.REMOVE THE EXISTING ACCESSORIES INCLUDING GRAB BARS.
7. REMOVE THE EXISTING LIGHT FIXTURES.
8. EXPOSE WALL AND CEILING FINISH IN ORDER TO RE-ROUTE THE UTILITY LINES TO THE NEW LOCATIONS AS SHOWN ON THE DRAWINGS.

CLEAN-UP AND REPAIR

1. DISPOSE OF ALL DEBRIS, RUBBISH AND OTHER SIMILAR MATERIALS RESULTING FROM THIS WORK FROM THE PROJECT SITE. TRANSPORT AND LEGALLY DISPOSE OF THIS MATERIAL OFF SITE.
2. IF HAZARDOUS MATERIALS ARE ENCOUINTERED DURING THIS SELECTIVE DEMOLITION OPERATION, THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE REGULATIONS, LAWS, AND ORDINANCES CONCERNING THE REMOVAL, HANDLING, AND PROTECTION AGAINST EXPOSURE OR ENVIRONMENTAL POLLUTION.
3. CLEAN PROJECT AREA COMPLETELY TO A "BROOM CLEAN" CONDITION.

DIVISION 3: CONCRETE

SECTION: 03 31 00: CONCRETE

CODES AND STANDARDS:

1. THE CONCRETE WORK SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF THE 2016 CALIFRONIA BUILDING CODE (CBC) AND AMERICAN CONCRETE INSTITUTE (ACI).

2. SUBMIT DESIGN MIX REPORTS TO THE MAINTENANCE AND OPERATIONS DEPARTMENT.

MATERIALS AND QUALITY CONTROL:

1. ALL CONCRETE SHALL HAVE 2500 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.

2. MINIMUM CEMENT CONTENT SHALL 6 SACKS MINIMUM PER CUBIC YARD.

3. MAXIMUM CONCRETE SLUMP SHALL BE 4-INCHES, PLUS OR MINUS 1-INCH.

4. CEMENT USED SHALL BE STANDARD BRAND, TYPE II, LOW ALKALI, PER ASTM C-150.

5. AGGREGATE USED SHALL CONFORM TO ASTM C-33, I-INCH MAXIMUM SIZE.

6. WATER- REDUCING AGENTS MAY BE USED TO CONTROL THE WATER-CEMENT RATIO, PER ASTM C-494.

7. INSTALL 10-MILS THICKNESS POLYETHYLENE MOISTURE BARRIER WITHIN THE UPPER 1-INCH OF BELOW-SLAB SAND.

8. INSTALL 4-INCHES MINIMUM CLEAN WASHED SAND UNDER THE CONCRETE SLAB FLOOR SECTIONS.

9. INSTALL REINFORCING STEEL, PER ASTM A-615, GRADE-60, AND IT SHALL CONFORM TO THE CBC, 2013 EDITION.

EXECUTION OF THE WORK:

1. CONCRETE SHALL BE MECHANICALLY VIBRATED DURING PLACEMENT.

2. POSITION, SUPPORT AND SECURE THE REINFORING STEEL AGAINST DISPLACEMENT.

3. COORDINATE THE FINISH ELEVATION WITH THE FINISHED FLOOR TILE INSTALLATION OR OTHER FINISH AS SHOWN ON THE DRAWINGS.

4. THE SOIL UNDER THE SLAB SHALL BE COMPACTED TO 90% PRIOR TO PLACEMENT OF SAND.

5. REPLACEMENT CONCRETE SLAB SHALL BE REINFORCED WITH #4, GRADE 60 BARS AT 24-INCHES ON CENTER EACH WAY AND DOWELED INTO EXISTING SLAB WITH #4 DOWEL BARS AT 48 INCHES ON CENTER.

6. PLACING THE CONCRETE SHALL COMPLY WITH ALL APPLICABLE PROVISIONS OF ACI. CONCRETE SHALL BE PLACED IN A CONTINUOUS OPERATION WITHIN THE PLANNED JOINTS AND/OR SECTIONS. CONCRETE PLACEMENT SHALL NOT BEGIN UNTIL WORK OF OTHER TRADES AFFECTING CONCRETE IS COMPLETED.

7. PROVIDE A LEVEL AND SMOOTH FINISH FOR AN EXPOSED-TO-VIEW FINISH. NOTE THE AREAS TO BE SLOPED TOWARDS THE FLOOR DRAINS AS SHOWN ON THE PLANS. APPLY A TROWEL FINISH TO THE SURFACE. THE FINISH TROWELLING SHALL BE FREE OF TROWEL MARKS, AND UNIFORM IN ALL RESPECTS IN TEXTURE AND APPEARANCE. REMOVE “FINS” AND PROJECTIONS, PATCH DEFECTIVE AREAS WITH CEMENT GROUT, AND GRIND TO A SMOOTH FINISH. BLEND THIS FINISH WITH THE EXISTING ADJACENT CONCRETE FLOOR SLAB.

8. BEGIN INITIAL CURING AS SOON AS EVIDENCE OF FREE WATER HAS DISAPPEARED FROM EXPOSED SURFACES. MAINTAIN CONTINUOUS MOISTURE FOR 72 HOURS MINIMUM BY MEANS OF MOISTURE RETAINING COVER.

9. PROVIDE PROTECTIONS AS REQUIRED IN ORDER TO PREVENT DAMAGE.

DIVISION 3: CONCRETE FINISHING

SECTION: 03 35 43: CONCRETE MICRO TOPPING

GENERAL PROVISIONS:

1. FURNISH AND INSTALL A MICRO TOPPING RESURFACING APPLICATION OVER THE EXISTING CONCRETE FLOOR SURFACE AS SHOWN ON THE PLANS.

2. THE EXISTING CONDITION OF THE CONCRETE FLOOR SLAB REQUIRES SPECIAL PRODUCT APPLICATION.

3. PREPARE THE EXISTING CONCRETE FLOOR TO RECEIVE THE MICRO TOPPING.

MATERIALS AND QUALITY CONTROL:

1. MICRO THIN BOND RESURFACING PRODUCT: SINAK RELAY™ POLYMER RESURFACER IS A PROPRIETARY PRIMERLESS READY-TO-USE WATER-BASED POLYMER THAT SHALL BE MIXED WITH WITH WATER AND SINAK RELAY™ POWDER. (SINAK CORP., 1949 WEST WALNUT AVE., SAN DIEGO, CA 92101: 800 / 523.3147 AND SURFACE FX INC., SANTA BARBARA, CA 805 / 963.3126)

2. USE THIS PRODUCT WITH SINAK RAPID SET® CEMENT FOR USE ON FLOORS.

3. COLOR: MATCH DUNN-EDWARDS DE 6365 “COLD MORNING”.

4. FINISH WITH A SEAL COAT PER SINAK CORPORATION.

5. GRIND IRREGULAR BUMPS AND SIMILAR IMPERFECTIONS FOR A LEVEL SURFACE. REMOVE ALL OILS AND GREASE, AND ANY SILICONE COATINGS OR SILICONE RESIDUE.

6. THOROUGHLY VACUUM AND CLEAN THE CONCRETE SUBSTRATE OF ANY LOOS DIRT, DUST AND DEBRIS. ENSURE THAT ALL MATERIALS THAT ARE SOFT, FLAKY, DUSTY AND/OR CHALKY. REMOVE ALL MATERIALS THAT ARE BOND-BREAKERS AND GYPSUM-BASED MATERIALS.

7. ALLOW CONCRETE TO DRY THOROUGHLY PRIOR TO INSTALLATION

8. PREPARE A PAINT-LIKE CONSISTENCY FOR THE REPAIR OF CRACKED AND DAMAGED EXISTING CONCRETE SUBSTRATE PER THE MANUFACTURER’S INSTRUCTIONS.

QUALITY CONTROL:

1. THIS PRODUCT IS NON-TOXIC AND VOC COMPLIANT.

2. BOND STRENGTH: 414-466 PSI; 434 AVERAGE PSI PER ASTM 4541

3. COMPRESSION STRENGTH: 6,225 PSI @ 7 DAYS AND 6,622 PSI @ 28 DAYS PER ASTM C 579.

4. ABRASION RESISTANCE: 1,000 CYCLES, H-22 CALIBRADE WHEELS. THE AVERAGE DEPTH OF WEAR IS 24 MILS (APPROXIMATELY EQUAL TO 5,000 PSI CONCRETE) PER ASTM C 501.

5. WEATHERING: THERE SHALL BE NO SIGN OF PEELING, CHALKING, BLISTERING, FADING, ALGAE GROWTH AND/OR ANY LOSS OF ADHESION, PER ASTM G 43.

6. SLIPPAGE RESISTANCE SHALL MEET OR EXCEED 65 (DRY AND 58 (WET), PER ASTM E 303 (BRITISH PENDULUM TEST)

EXECUTION OF THE WORK:

1. DETERMINE THE SUITABILITY OF THE MIXTURE CONSISTENCY WITH THE METHOD AND PURPOSE OF THE APPLICATION.

2. CRACK REPAIR MIXTURES SHALL HAVE A MORTAR-LIKE THICKNESS.

3. REPAIR DEEP CRACKS, NON-MOVING JOINTS, PITS AND POT-HOLES DURING THE PREPARATION PHASE.

4. APPLICATION OF SINAK RELAY SHALL BE MADE WITH THE TOOLS SUITABLE FOR THE APPLICATION PER THE MANUFACTURER'S INSTRUCTIONS.

5. APPLY A MINIMUM OF 2 COATS.

6. 3 COATS OR MORE MAY BE NECESSARY TO SMOOTH OVERLY ROUGH OR PITTED CONCRETE SUBSTRATE.

7. PROTECT THE TREATED SURFACE FROM EXPOSURE TO WATER FOR 24 HOURS MINIMUM.

8. DO NOT ALLOW THIS PRODUCT TO HARDEN ON SURFACES NOT INTENDED FOR RESURFACING.

9. PROVIDE PROTECTIONS AS REQUIRED IN ORDER TO PREVENT DAMAGE.

DIVISION 5: METALS

SECTION 05 40 00: LIGHT GAUGE METAL FRAMING

GENERAL PROVISIONS

1. FURNISH AND INSTALL ALL LIGHT GAUGE METAL STUD FRAMING, BLOCKING, CANT STRIPS, NAILERS, FURRING, MISCELLANEOUS TRACKS, CHANNELS, BRIDGING AND ALL METAL CLIPS, ANGLES, NAILS, SCREWS, GLUE(S), ACCESSORIES AND FASTENERS NECESSARY FOR A COMPLETE INSTALLATION..
2. THIS ROUGH FRAMING SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.
3. QUALITY CONTROL STANDARDS:
   A. ASTM A-446 STANDARD SPECIFICATION FOR STEEL SHEET, ZINC-COATED (GALVANIZED) BY THE HOT DIP PROCESS, STRUCTURAL (PHYSICAL) QUALITY
   B. ASTM A-525 STANDARD SPECIFICATION FOR STEEL SHEET, ZINC-COATED (GALVANIZED) BY THE HOT DIP PROCESS
   C. ASTM A-568 STANDARD SPECIFICATION FOR STEEL, SHEET CARBON, AND HIGH-STRENGTH, LOW ALLOY, HOT-ROLLED AND COLD-ROLLED
   D. ASTM A-780 PRACTICE FOR REPAIR OF DAMAGED HOT-DIP GALVANIZED COATINGS
   E. ASTM C-955 STANDARD SPECIFICATION FOR LOAD BEARING (TRANSVERSE AND AXIAL) STEEL STUDS, RUNNERS (TRACK), AND BRACING OR BRIDGING FOR SCREW APPLICATION OF GYPSUM BOARD AND METAL PLASTER BASES
   F. ASTM C-1002 STANDARD SPECIFICATION FOR STEEL DRILL SCREWS FOR THE APPLICATION OF GYPSUM BOARD
   G. ASTM A-1003 / A-1003M TYPE H STEEL FRAMING ACCESSORIES OF THE SAME GRADE AND COATING WEIGHT USED FOR THE FRAMING MEMBERS
   H. ASTM C-1007 STANDARD SPECIFCATION FOR THE INSTALLATION OF LOAD BEARING (TRANSVERSE AND AXIAL) STEEL STUDS AND RELATED ACCESSORIES
   I. ASTM C-1513 STANDARD SPECIFICATION FOR CORROSION-RESISTANT-COATED, SELF-DRILLING, SELF-TAPPING STEEL DRILL SCREWS FOR COLD-FORMED STEEL FRAMING CONNECTIONS

J. AMERICAN WELDING SOCIETY AWS D-1.3 STRUCTURAL WELDING CODE – STEEL SHEET

K. FIRE RESISTIVE WALL ASSEMBLIY RATING: WHERE A FIRE RESISTIVE RATING IS REQUIRED AND/OR SHOWN ON THE PLANS, THE CONTRACTOR SHALL PROVIDE THE MATERIALS AND APPROPRIATE INSTALLATION THAT IS IN COMPLIANCE WITH ASTM E-119 BY THE FIRE TESTING LABORATORIES ACCEPTABLE TO TO THE AGENCIES HAVING JURISDICTION

L. ALL PLYWOOD SHALL BE PER AMERICAN PLYWOOD ASSOCIATION (APA) GRADE-TRADEMARKED AS COMPLYING WITH THE APA PERFORMANCE STANDARD FOR STRUCTURAL USE PANELS. ALL PLYWOOD BACKING SUPPORT PANELS FOR ELECTRICAL AND COMMUNICATION EQUIPMENT SHALL BE APA C-D PLUGGED INTERIOR WITH EXTERIOR GLUE, FIRE RETARDANT TREATED, ½" THICK EXCEPT AS NOTED OTHERWISE .

M. PARTICLE BOARD SHALL BE STAMPED AS BEING IN COMPLIANCE WITH THE APA PERFORMANCE STANDARD.

SUBMITTALS:

1. SHOP DRAWINGS: THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR SPECIAL CONDITIONS AND FOR SPECIAL COMPONENTS THAT MAY NOT BE FULLY DIMENSIONED OR DETAILED IN THE MANUFACTURER'S PRODUCT INFORMATION.
2. SHOP DRAWINGS: SHOW CONNECTION DETAILS WITH SCREW TYPES AND LOCATIONS, WELD LENGTHS AND LOCATIONS, AND ALL OTHER FASTENER REQUIREMENTS
3. SHOP DRAWINGS: VERIFY ATTACHMENTS TO THE STRUCTURE AND TO ADJACENT FRAMING COMPONENTS
4. WELDING: ALL WELDS, BOTH SHOP AND FIELD, SHALL BE INDICATED USING THE AWS "WELDING SYMBOLS, 2.0"

MATERIALS:

1. LIGHT GAUGE STEEL FRAMING (STUDS AND JOISTS) AS INDICATED ON THE DRAWINGS WITH RESPECT TO SIZE AND GAUGE, INCLUDING RUNNERS, TRACKS, AND ALL RELATED ACCESSORIES.
2. MANUFACTURERS – SELECT FROM ONE OF THE FOLLOWING:
   A. ALLIED STUDCO – STUDCO BUILDING SYSTEMS US LLC
   B. ALLSTEEL & GYPSUM PRODUCTS, INC

C. CALIFORNIA EXPANDED METAL PRODUCTS COMPANY

D. CEMCO, INC

E. CLARK DIETRICH BUILDING SYSTEMS LLC

F. CONSOLIDATED FABRICATORS CORPORATION

G. CRACO METALS MANUFACTURING LLC

H. CUSTOM STUD, INC

I. DALE/INCOR

J. SCAFCO CORPORATION

3. WALL FRAMING SHALL BE **C**-SHAPED STEEL STUDS OF WEB DEPTHS AS SHOWN ON THE DRAWINGS, PUCHED, WITH STIFFENED FLANGES AND AS FOLLOWS:

   A. 18 GAUGE (0.0428-INCH) WITH A FLANGE WIDTH DIMENSION OF 1-5/8”

   B. SIZES: 250S162-43 (2-1/2”), 350S162-43 (3-1/2”), 362S162-43 (3-58”), 400S162-43 (4”), 600S162-43 (6”), 800S162-43 (8”) AS SHOWN ON THE DRAWINGS

   C. ADDITIONAL DESIGNATIONS: T=TRACK SECTIONS OF WIDTHS TO MATCH THE STUD FRAMING; F=FURRING CHANNELS

   D. DEFLECTION CLIPS SHALL BE THE MANUFACTURER’S STANDAD STEEL CLIPS CAPABLE OF ACCOMMODATING VERTICAL (UPWARD AND DOWNWARD) DISPLACEMENT OF THE STUDWALL STRUCTURE BY MEANS OF A POSITIVE MECHANICAL ATTACHMENT TO THE STUD WEB.

4. INSTALL SCAFCO PONYWALL 12 GAUGE STEEL SUPPORTS (48-INCH HEIGHT) FACTORY WELDED TO A 3/16” BASE PLATE SHALL BE INSTALLED WITHIN THE WALL CAVITY BETWEEN EACH LAVATORY WITH (6)-5/8” x 3” CONCRETE ANCHORS. REFER TO THE ARCHITECTURAL DETAIL SHOWING THE LAVATORY COUNTER SUPPORT.

5. WALL SHEATHING: REFER TO NOTES ON THE DRAWINGS WHERE APPLICABLE.

6. PLYWOOD SHEATHING: REFER TO STRUCTURAL NOTES ON THE DRAWINGS (WHERE APPLICABLE).

7. METAL FRAMING CONNECTORS: MANUFACTURER’S STIFFENERS, BLOCKING MEMBERS, UTILITY ANGLES, JOIST HANGERS, GUSSET PLATES, RIGID CLIPS SUITABLE FOR THE PROJECT

8. NON-COMBUSTIBLE LUMBER AND PLYWOOD SHALL BE AS SHOWN ON THE DRAWINGS AS FIRE RETARDENT TREATED WITH PRESSURE-IMPREGNATED FIRE RETARDANT MONOMERIC RESIN SOLUTION AND THEN KILN-DRIED TO CURE CHEMICALS IN WOOD. TREATMENT SHALL HAVE A U.L. DESIGNATION OF "FRS" OF FLAME SPREAD RATING OF **25** MAXIMUM, AND C.B.C., 2016 ED., SECT. 2303.2. THIS TREATMENT SHALL BE AS MANUFACTURED BY ARCH WOOD PROTECTION, INC., DRICON (ESR-1626); OR OSMOSE, INC., FIREPRO FLAME PROOF LHC TREATMENT (NER-577).

9. POWER ACTUATED SHOT PIN ANCHORS SHALL BE BY HILTI CORPORATION (ESR-1663) AND PER ASTM E-1190.

10. CUT OPENINGS AS REQUIRED FOR VENT LINES, DUCTS, AND SIMILAR PENETRATIONS. COORDINATE THIS AND SIMILAR WORK THE RESPECTIVE ELECTRICAL, PLUMBING AND H.V.A.C SUB-CONTRACTORS.

11. FASTENERS: (NAILING AND HARDWARE)

    A. PROVIDE ALL SCREWS, NUTS, BOLTS AND WASHERS WITH A CORROSION RESISTANT FINISH NECESSARY FOR A COMPLETE INSTALLATION.

    B. SELF-TAPPING SHEET METAL SCREWS SHALL BE USED WHEN ATTACHING WOOD MEMBERS, PLYWOOD AND SIMILAR WOOD PRODUCTS TO METAL FRAMING.

    C. BOLTS: MACHINE BOLTS SHALL BE PER ASTM A-307, GRADE A. BOLTS SHALL INCLUDE STEEL WASHERS WHERE HEAD AND NUT BEAR ON WOOD. DRILL BOLT HOLES 1/16" LARGER THAT BOLT DIAMETER. LAG BOLTS (LAG SCREWS) SHALL BE TURNED, NOT DRIVEN.

12. STEEL STOPS ON THE STUD FRAMING AT ELECTRICAL WORK SHALL BE #NS-16, 16 GAUGE GLAVANIZED STEEL PER C.E.C., 2016 ED., AND SHALL BE BY SIMPSON STRONG-TIE COMPANY, INC., OR EQUAL.

13. INSULATION: PER ASTM C-665, TYPE 1, UNFACED MINERAL FIBER BLANKETS

PERFORMANCE

1. THE CONTRACTOR AT HIS OWN EXPENSE SHALL REMOVE ANY FRAMED PARTITION IN ORDER TO ACCESS THE JOBSITE. CONFIRM ALL FINAL AND AS-BUILT DIMENSIONS. INSTALL NEW PARTITIONS AS SHOWN DRAWINGS.

2. COMPLY WITH THE AISI "STANDARD FOR COLD-FORMED STEEL FRAMING – PRESCRIPTIVE METHOD"

3. TOUCH-UP ALL FIELD WELDS AND DAMAGED GALVANIZED SURFACES WITH A MANUFACTURER APPROVED PRIMER.

4. INSTALLATION:

   PROVIDE ALL TEMPORARY GUYING, SHORING AND BRACING REQUIRED TO ERECT AND SECURE ALL STUD FRAMING IN TRUE AND PLUMB ALIGNMENT. INSTALL ALL FRAMING PLUMB, LEVEL AND TRUE.

   PROVIDE STUDS, BLOCKING, NAILERS, FURRING, GROUNDS, SLEEPERS, STRIPS AND SIMILAR LIGHT GAUGE STEEL MEMBERS FOR ALL ACCESSORIES ATTACHED TO THE WALLS SUCH AS TOILETS, TOILET ACCESSORIES, TOILET PRIVACY PARTITIONS, DISPENSERS, SHELVING, CASEWORK AND COUNTERS.

5. FASTENERS SHALL BE LOCATED PER MANUFACTURER'S SPECIFICATIONS USING A MINIMUM OF 2 SELF-TAPPING SELF-DRILLING SCREWS PER CONNECTION, UNLESS OTHERWISE INDICATED.

6. ANCHOR RUNNER TRACK SECURELY TO THE SUPPORTING STRUCTURE AS SHOWN ON ERECTION DRAWINGS. INSTALL CONCRETE ANCHORS ONLY AFTER FULL COMPRESSIVE STRENGTH HAS BEEN ACHIEVED. PROVIDE A SILL SEALER OR GASKET BARRIER BETWEEN ALL CONCRETE AND STEEL CONNECTIONS.

7. BUTT ALL TRACK JOINTS. SECURELY ANCHOR ABUTTING PIECES OF TRACK TO A COMMON STRUCTURAL ELEMENT, OR BUTT-WELD OR SPLICE TOGETHER.

8. ENSURE THE ALIGNMENT AND PLUMB STUDS AND SECURELY ATTACH TO FLANGES OR WEBS OF BOTH UPPER AND LOWER TRACKS

9. ATTACH WALL STUD BRIDGING IN A MANNER TO PREVENT STUD ROTATION. SPACE BRIDGING ROWS ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

10. PLACE STUDS AT MAXIMUM 16 INCHES ON CENTER, NOT MORE THAN 2 INCHES FROM ABUTTING WALLS, AND AT EACH SIDE OF OPENINGS.

11. USE DOUBLE STUDS, ONE OF WHICH IS FULL LENGTH UNLESS INDICATED OTHERWISE, AT WALL OPENINGS, DOORS AND WINDOW JAMBS.

12. CONSTRUCT CORNERS USING A MINIMUM OF 3 STUDS.

13. CONNECT STUDS TO TRACKS AND RUNNERS USING MECHANICAL FASTENERS.

14. INSTALL FRAMING BETWEEN STUDS FOR ATTACHMENT OF MECHANICAL AND ELECTRICAL ITEMS, AND TO PREVENT STUD ROTATION.

15. ATTACH CROSS STUDS OR FURRING CHANNELS TO STUDS FOR ATTACHMENT OF FIXTURES ANCHORED TO WALLS.

16. PROVIDE BRIDGING (HORIZONTAL STIFFENERS) AT 4'-0" ON CENTER MAXIMUM VERTICAL SPACING.

17. LIGHT GAUGE STEEL JOISTS:

    A. PROVIDE LIGHT GAUGE STEEL CEILING LOISTS OF DEPTHS INDICATED, PUNCHED WITH SERVICE HOLES AND STIFFENED FLANGES.

    B. LOCATE JOIST END BEARING DIRECTLY OVER LOAD BEARING STUDS OR PROVIDE LOAD-DISTRIBUTING MEMBER TO TOP OF STUD TRACK.

    C. PROVIDE WEB STIFFENERS AT REACTION POINTS AND WHERE INDICATED IN DRAWINGS.

    D. PROVIDE JOIST BRIDGING.

    E. PROVIDE END BLOCKING WHERE JOIST ENDS ARE NOT OTHERWISE RESTRAINED FROM ROTATION.

    F. PLACE JOISTS AT MAXIMUM 12 INCHES ON CENTER AND NOT MORE THAN 2 INCHES FROM ABUTTING WALLS.

    G. CONNECT JOISTS TO SUPPORTS USING MECHANICAL FASTENERS.

CLEANING

1. REPAIR DAMAGE TO ADJACENT MATERIALS CAUSED BY FRAMING INSTALLATION.

2. PERFORM A COMPLETE CLEANUP.

3. UPON COMPLETION, REMOVE SURPLUS MATERIALS, RUBBISH, TOOLS AND EQUIPMENT.

4. COORDINATE RECYCLING OF WASTE MATERIALS IN COMPLIANCE WITH ALL REGULATIONS. COLLECT THE RECYCLABLE WASTE AND DISPOSE OF OR RECYCLE FIELD GENERATED CONSTRUCTION WASTE CREATED DURING DEMOLITION, CONSTRUCTION OR FINAL CLEANING.

DIVISION 06: ARCHITECTURAL CASEWORK

SECTION: 06 41 00: ARCHITECTURAL CASEWORK

GENERAL PROVISIONS

1. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE INSTALLATION OF ALL MILLWORK, APPLIANCES AND ACCESSORIES TO PROVIDE A COMPLETE INSTALLATION PER THE DRAWINGS, SPECIFICATIONS AND ADDENDA. THE CONTRACTOR SHALL ALWAYS REFER TO THE FLOOR PLANS FOR LOCATIONS OF THESE ITEMS. THE WOODWORK INSTITUTE OF CALIFORNIA (WIC) MANUAL OF MILLWORK IS INCORPORATED BY REFERENCE IN THESE SPECIFICATIONS.
2. THIS SECTION INCLUDES THE FABRICATION AND INSTALLATION OF THE CASEWORK, LAMINATED PLASTIC EXPOSED VENEER, MELAMINE INTERIOR VENEER, FINISH CABINET HARDWARE, WOOD BACKING AND BLOCKING.
3. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ALL MEASUREMENTS AND AS-BUILT CONDITIONS.
4. THE DESIGN DRAWINGS, THE GENERAL CONDITIONS OF THE CONTRACT, THE SPECIFICATIONS AND ALL ADDENDA WITH THEIR EXPLANATORY NOTES AND FIGURES FURNISHED BY THE ARCHITECT AND THE CLIENT FOR THIS WORK ARE TO BE TAKEN TOGETHER AS A WHOLE TO ILLUSTRATE EACH OTHER, AND SHALL CONSTITUTE THE MILLWORK FABRICATION AND INSTALLATION CLIENT AND THE CONTRACTOR.

REFERENCES AND QUALITY CONTROL:

1. THE WOODWORK INSTITUTE OF CALIFORNIA (W.I.C.) MANUAL OF MILLWORK IS ADOPTED AS A PART OF THIS SPECIFICATION.
2. CABINETWORK, AS INDICATED, SHALL BE MANUFACTURED OR FABRICATED IN ACCORDANCE WITH THE STANDARD DETAILS AND SPECIFICATIONS OF WIC MANUAL OF MILLWORK. CUSTOM GRADE.
3. REFERENCES:
    A. AMERICAN PLYWOOD ASSOCIATION (APA): U.S. PRODUCT STANDARD PS 1 FOR CONSTRUCTION AND INDUSTRIAL PLYWOOD
    B. ASTM E 84: TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS
    C. WEST COAST LUMBER INSPECTION BUREAU (WCLB): WCLB No. 17 STANDARD GRADING RULES
4. ALL WORK SHALL BE DONE IN A WORKMANLIKE, PRECISE, NEAT AND SKILLFUL, MANNER EXACTLY AS DESIGNED AND SPECIFIED. IN CASES OF CONFLICT, THE HIGHEST STANDARD SHALL GOVERN. ALL NEW WORK MATERIALS INSTALLED SHALL BE

FREE FROM DEFECTS AND SUITABLE FOR THE INTENDED USE. SHOULD ANY WORKMANSHIP OR MATERIALS BE REQUIRED WHICH IS NOT DIRECTLY SHOWN ON THE DRAWINGS OR NOTED IN SPECIFICATIONS, BUT IS NEVERTHELESS NECESSARY FOR THE PROPER PERFOR¬MANCE OF THE OBVIOUS INTENTIONS OF THE WORK, THE CONTRACTOR SHALL BE EXPECTED TO UNDERSTAND THIS BY IM¬PLICATION AND SHALL PROVIDE FOR THIS CONTINGENCY IN THE BID AS FULLY AS IF IT WERE SPECIFICALLY DELINEATED OR DESCRIBED.

SUBMITTALS:

1. SHOP DRAWINGS: SUBMIT FULLY DETAILED SHOP DRAWINGS OF THE CABINETWORK, INCLUDING PLASTIC LAMINATE WORK AND COUNTERTOP EDGING. SHOP DRAWINGS SHALL BE PREPARED IN ACCORDANCE WITH WIC MANUAL OF MILLWORK, SECTION 1, "MILLWORK SHOP DRAWINGS".

2. CHECKING OF SHOP DRAWINGS BY THE ARCHITECT SHALL BE CON¬SIDERED MERELY AS ASSISTING THE CONTRACTOR AND IN NO WAY RELEASES THE CONTRACTOR FROM ANY RESPONSIBILITY FOR ERRORS. WHEN REQUESTED THE CONTRACTOR SHALL FURNISH SAMPLES OF THE MATERIALS AND COLORS TO BE USED IN THE EXECUTION OF THE WORK SPECIFIED OR DESCRIBED ON DRAWINGS. ALL MATERIALS AND WORKMANSHIP FURNISHED SHALL BE FULLY EQUAL TO SAMPLES SUBMITTED AND APPROVED.

3. PRODUCT DATA: SUBMIT MANUFACTURERS' PRODUCT DATA FOR PLASTIC LAMINATES, CABINET HARDWARE, AND ANY OTHER MANUFACTURED OR FABRICATED ITEMS INDICATED OR SPECIFIED.

4. SAMPLES: SUBMIT SAMPLES OF PLASTIC LAMINATES AND CABINET FINISH HARDWARE.

PRODUCT DELIVERY, STORAGE AND HANDLING:

1. THE CASEWORK, DELIVERY AND STORAGE PROCEDURES SHALL BE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE W.I.C. MANUAL OF MILLWORK, SECTION 1 – GENERAL REQUIREMENTS.

2. DO NOT DELIVER CASEWORK UNTIL ALL PAINTING, FINISHING AND OVERHEAD WORK IS COMPLETE IN THE SPACES TO RECEIVE CASEWORK.

3. PROTECT FINISHED SURFACES FROM SOILING AND DAMAGE DURING HANDLING AND INSTALLATION. KEEP COVERED WITH POLYETHYLENE FILM OR OTHER PROTECTIVE COVERING.

4. STORE CASEWORK IN A DRY LOCATION OF THE BUILDING, OUT OF THE WAY OF OTHER CONSTRUCTION ACTIVITIES.

JOB CONDITIONS:

1. COORDINATE WITH PLUMBING, MECHANICAL, AND ELECTRICAL WORK AND UNIVERSITY FURNISHED EQUIPMENT FOR PROPER SIZING, LOCATION, AND SEQUENCE OF CONSTRUCTION.
2. ALL CUTOUTS AND HOLES FOR MECHANICAL, PLUMBING AND ELECTRICAL WORK SHALL BE MADE AT THE PROJECT SITE.

MATERIALS:

1. ALL CASEWORK SHALL COMPLY WITH CUSTOM GRADE, PLASTIC LAMINATE FINISH AS DEFINED BY WIC, UNLESS OTHERWISE SPECIFIED OR SHOWN ON DRAWINGS.
2. WOOD BACKING AND BLOCKING:
   A. WOOD BACKING AND BLOCKING SHALL BE "CONSTRUCTION" OR "NO. 1" GRADE DOUGLAS FIR AS DEFINED IN WCLB NO. 17, OF SIZE AND DIMENSIONS INDICATED OR REQUIRED. MOISTURE CONTENT SHALL NOT EXCEED 19 PERCENT AT TIME OF INSTALLATION.
   B. WOOD AND PLYWOOD BACKING AND BLOCKING SHALL BE SECURED TO METAL FRAMING WITH SCREWS OR BOLTS MANUFACTURED FOR THE PURPOSE OF TYPE AND SIZE REQUIRED FOR THE INSTALLATION.
   C. ALL ANCHORS AND FASTENERS SHALL BE STAINLESS STEEL, GALVANIZED, OR SPECIALLY TREATED TO PREVENT CORROSION.
3. CABINET MATERIALS:
   A. CONCEALED SOLID LUMBER: ANY SPECIES CONTAINING NO DEFECTS WHICH MATERIALLY AFFECT STRENGTH OR UTILITY OF PIECE.
   B. CONCEALED PLYWOOD: ANY HARDWOOD SPECIES CONTAINING NO DEFECTS WHICH MATERIALLY AFFECT STRENGTH OR UTILITY OF PIECE. FRONT SURFACES OF BACK PANELS OF CASEWORK SHALL BE SOLID, MELAMINE OR EQUAL.
   C. PARTICLE BOARDS: THESE APPROVED TYPES OF HIGH DENSITY PARTICLE BOARD, TIMBLEND, DURAFLAKE AND NOVOPLY, OR APPROVED EQUAL, MAY BE USED EXCEPT ON DRAWER FRONTS AND SIDES, FACE EDGINGS, BASE AND FRAMING MEMBERS, SHELVES AND PANELS OF ANY TYPE LESS THAN 1/2" THICK.
   D. PLASTIC LAMINATE: WILSONART SLATE GREY D-91-60; 0.028” THICK MINIMUM FOR ALL VERTICAL SURFACES AND 0.04” THICK MINIMUM FOR HORIZONTAL SURFACES, AND SHALL COMPLY WITH NEMA LD3 STANDARD.
   E. WOODEN SHELVES: WILSONART SLATE GREY D-91-60 LAMINATED SHELVES SHALL BE ¾” THICK AND CONSTRUCTED OF MEDIUM DENSITY FIBERBOARD (MDF). FIXED SHELVES ARE TO BE DADOED INTO THE BACK PANEL. ADJUSTABLE SHELVES SHALL BE NOTCHED TO RECEIVE PINS. THE PLASTIC LAMINATE SHALL COVER ALL SURFACES AND EDGES.

F. EDGE BANDING OF DOORS, DRAWERS AND EXPOSED END PANELS SHALL BE PLASTIC LAMINATE TO MATCH THE VERTICAL SURFACE.

G. INTERIOR SURFACES (NOT PREVIOUSLY NOTED): MELAMINE GREY.

H. COUNTERTOPS: DUPONT CORIAN “LAVA ROCK” MATTE FINISH SOLID SURFACE

1) SOLID SURFACE: NON-POROUS, HOMOGENEOUS MATERIAL MAINTAINING THE SAME COMPOSITION THROUGHOUT THE PART WITH A COMPOSITION OF ACRYLIC POLYMER, ALUMINUM TRIHYDRATE FILLER AND PIGMENT.

2) SUBMIT SAMPLE: 6”x6”, CUT AND SEAM TOGETHER TO REPRESENT AN INCONSPICUOUS SEAM. INCLUDE THE FULL RANGE OF COLORS AND PATTERN VARIATION.

3) INSTALL THE SOLID SURFACE OVER ¾” HARDWOOD PLYWOOD EXTERIOR GRADE THAT IS MOISTURE RESISTANT AND USE ONLY A WATERPROOF ADHESIVE AND SEALANTS AS RECOMMENDED BY THE MANUFACTURER WITH VOC QUANTITIES LOWER THAN THE STATED IN SCAQMD RULE 1168, AND THAT SHALL NOT EXCEED 250g/L UNDER ANY CIRCUMSTANCES.

4) INCLUDE FRONT EDGE DETAIL, BACKSPLASHES AND END SPLASHES AS SHOWN ON THE DRAWINGS. COVE THE BACK AND END SPLASHES.

5) PROVIDE HOLES AND CUTOUTS FOR PLUMBING WORK AS NECESSARY PER THE MANUFACTURER’S INSTRUCTIONS.

6) PROVIDE MANUFACTURER’S APPROVED ADHESIVES, SEALANTS, MOUNTING CLIPS, BRASS INSERTS AND OTHER FASTENERS FOR THE ATTACHMENT OF UNDERMOUNT SINKS AND/OR BOWLS.

7) MAKE ADJUSTMENTS FOR CLEARANCES OF DOORS AND DRAWERS.

8) PROMPTLY CORRECT ANY DEFECTS OR DEFICIENCIES

9) SUBMIT MANUFACTURER'S CARE AND MAINTENANCE DATA, INCLUDING REPAIR AND CLEANING INSTRUCTIONS. INCLUDE IN PROJECT CLOSEOUT DOCUMENTS.

10) MANUFACTURER WARRANTY: PROVIDE MANUFACTURER’S STANDARD WARRANTY FOR MATERIAL ONLY FOR PERIOD OF 10 YEARS AGAINST DEFECTS AND/OR DEFICIENCIES.

4. HARDWARE:

A. HINGES: HEAVY DUTY WRAP-AROUND HINGES. DESIGN TO MATCH SPECIFIED NUMBERS, SELF-CLOSING, BRUSHED CHROME FINISH.

1) PROVIDE 95% OPENING FOR CABINET DOOR HINGES ADJACENT TO PARTITION, BLUM INSERTA OR HAEFELE SELF-CLOSING.

2) PROVIDE 175% OPENING FOR ALL OTHER CABINET DOORS HINGES, BLUM INSERTA OR HAEFELE SELF-CLOSING.

B. DRAWER SLIDES: FULL EXTENSION BALL BEARING SLIDES WITH MINIMUM 125 POUND CAPACITY; K&V, OR EQUAL..

C. DOOR AND DRAWER PULLS: SUGATSTUNE #7020 70 SERIES HANDLES, NO KNOWN EQUAL.

D. LOCKS: MANUFACTURER'S STANDARD CYLINDER LOCK, BRUSHED CHROME FINISH.

E. PILASTER SUPPORTS: ADJUSTABLE CABINET SHELVES SHALL BE MOUNTED ON LINE BORING HOLES @ 32 MM ON CENTER X 5 MM DIAMETER HOLE WITH PINS FURNISHED.

F. GLUE: PLYWOOD SHALL BE GLUED WITH WATER-RESISTANT UREA RESIN GLUE OR PHENOL FORMALDEHYDE RESIN GLUE AND PROCESSED BY THE HOT PLATE METHOD.

FABRICATION:

1. FABRICATE CASEWORK IN ACCORDANCE WITH WIC CUSTOM GRADE AS SPECIFIED BELOW, AND AS SHOWN ON DRAWINGS AND APPROVED SHOP DRAWINGS. DESIGN DRAWINGS AND SPECIFICATIONS SHALL SUPERSEDE THE WIC STANDARDS.
2. SHOP-FABRICATE CASEWORK IN WHOLE UNITS OR IN PARTIAL UNITS AS MOST PRACTICAL FOR HANDLING AND TRANSPORTATION. ASSEMBLE PARTIAL UNITS IN PLACE IN SUCH MANNER THAT EACH PIECE OF CASEWORK BECOMES A UNIFIED WHOLE VISUALLY AND STRUCTURALLY. FABRICATE FILLERS AND SCRIBE STRIPS OF SAME MATERIAL AND FINISH AS CABINET WITH WHICH THEY ARE ASSOCIATED.
3. FABRICATE ALL CASEWORK WITH MDF OR LUMBER CORE PLYWOOD ONLY.
4. ALL CABINETS SHALL BE STYLE A, FRAMELESS, IN ACCORDANCE WITH WIC STANDARDS, CUSTOM GRADE.
5. ALL EXPOSED AND SEMI-EXPOSED SURFACES SHALL BE HIGH-PRESSURE PLASTIC LAMINATE FINISH. PROVIDE HIGH-PRESSURE LAMINATE CABINET LINER FOR ALL CABINET SURFACES WHEN BEHIND SOLID DOORS, EXCEPT FOR SHELVING SURFACES AS SPECIFIED. BACKS OF DOORS AND OPEN SHELF UNITS WILL BE CONSIDERED EXPOSED AND SHALL MATCH COLOR OF EXPOSED PORTIONS.
6. SWINGING DOORS: WIC CABINET DOOR TYPE "A", WITH PLASTIC LAMINATE EDGE BAND ON DOORS OF MEDIUM DENSITY FIBERBOARD (MDF) AND APPLY PLASTIC LAMINATE TO BOTH VERTICAL SURFACES.
7. DRAWER FRONTS: APPLY PLASTIC LAMINATE TO VERTICAL SURFACES AND EDGES
8. DRAWERS: DRAWERS SHALL BE OF RABBETED CONSTRUCTION AND WELL GLUED. FRONTS SHALL BE NOT LESS THAN 3/4" THICK MEDIUM DENSITY FIBERBOARD (MDF) CORE CONSTRUCTION. SIDES AND BACKS SHALL BE 1/2" THICK WHEN ANGLE SLIDES ARE USED, OR 5/8" THICK WHEN EXTENSION SLIDES ARE USED. DRAWER BOTTOMS SHALL BE 1/4", OR 3/8" THICK FOR DRAWER BOTTOMS OVER FOUR SQUARE FEET OF MDF. BOTTOMS SHALL BE DADOED INTO SIDES, BACKS AND FRONTS. DRAWERS SHALL BE PROVIDED WITH LOCKS AND LOCKING DEVICES WHERE INDICATED.
9. THE SOLID SURFACE INSTALLER SHALL EXAMINE THE CABINET SUBSTRATES TO VERIFY ARE LEVEL TO WITHIN 1/8" IN 10'-0" LENGTH, AND TO VERIFY THE SITE DIMENSIONS AND ADJACENT FINISH MATERIALS FOR A SEAMLESS AND ACCURATE INSTALLATION.

INSTALLATION:

1. ACCURATELY FIT ALL CASEWORK AND COMPONENTS.
2. VERIFY THAT SURFACES AND SPACES TO RECEIVE CASEWORK ARE SATISFACTORY FOR INSTALLATION. IF UNSATISFACTORY CONDITIONS EXIST, DO NOT COMMENCE INSTALLATION UNTIL SUCH CONDITIONS HAVE BEEN CORRECTED.
3. INSTALL CASEWORK AND COUNTERTOPS STRAIGHT, PLUMB LEVEL AND TRUE WITH NO DISTORTIONS. SHIM AS REQUIRED USING CONCEALED SHIMS. WHERE CASEWORK ABUTS OTHER FINISHED WORK, SCRIBE AND APPLY FILLER STRIPS FOR ACCURATE FIT WITH ALL FASTENERS CONCEALED WHERE PRACTICABLE.
4. SECURE BASE CABINET TO FLOOR AT TOE SPACE WITH FASTENERS SPACED 24" ON CENTER, UNLESS OTHERWISE SHOWN ON DRAWINGS, AND BOLT CONTIGUOUS CABINETS TOGETHER. SECURE INDIVIDUAL CABINETS WITH NOT LESS THAN TWO FASTENERS INTO FLOOR WHERE THEY DO NOT ADJOIN OTHER CABINET.
5. WHERE REQUIRED, ASSEMBLE UNITS INTO ONE INTEGRAL UNIT WITH JOINT FLUSH, TIGHT, AND UNIFORM. ALIGN SIMILAR ADJOINING DOORS AND DRAWERS TO A TOLERANCE OF 1/16".
6. BASE CABINETS SHALL BE INSTALLED SO THAT ANY ONE CABINET WITHIN A ROW CAN BE REMOVED OR INSTALLED WITHOUT DISTURBING ADJOINING CABINETS.
7. PROVIDE HOLES AND CUTOUTS FOR MECHANICAL, PLUMBING AND ELECTRICAL WORK AS NECESSARY TO COORDINATE WITH OTHER WORK. PROVIDE STAINLESS STEEL ESCUTCHEONS FOR ALL UTILITIES THROUGH CABINETS.
8. SECURE ALL WALL HUNG CABINETS TO BACKING PLATES AS SHOWN AND SCHEDULED. ANCHOR, ADJUST, AND ALIGN WALL HUNG CABINETS AS SPECIFIED FOR BASE CABINETS.
9. PROVIDE FILLERS AND SCRIBE STRIPS SO THAT CABINET FRONTS, AND SIDES PRESENT A FINISHED AND UNBROKEN SURFACE TO ADJACENT CABINET UNITS OR PARTITIONS. CUT SCRIBE STRIPS SO THAT NO GAP GREATER THAN 1/16" EXISTS WHERE CASEWORK IS FITTED AGAINST FLAT OR IRREGULAR SURFACES.

ADJUSTMENT, REPAIR AND CLEAN-UP:

1. REPAIR ANY DAMAGED AND DEFECTIVE CASEWORK , CABINETS AND COUNTERTOPS TO ELIMINATE DEFECTS FUNCTIONALLY AND VISUALLY. WHERE REPAIRS ARE NOT POSSIBLE TO REPAIR, THE CASEWORK, CABINETS AND COUNTERTOPS SHALL BE REPLACED AT NO EXPENSE TO THE OWNER.
2. THE JOINERY OF THE UNITS SHALL BE ADJUSTED FOR A UNIFORM APPEARANCE.
3. CLEAN, LUBRICATE AND MAKE ALL NECESSARY FINAL ADJUSTMENTS TO ALL HARDWARE. FOLLOW THE MANUFACTURER'S INSTRUCTIONS WHERE APPLICABLE.
4. PROVIDE FINAL PROTECTION IN PLACE TO MAINTAIN THE INSTALLATION IN A MANNER ACCEPTABLE TO THE OWNER, THE INSTALLER AND/OR THE MANUFACTURER THAT ENSURES THE ENTIRE CASEWORK AND CABINET INSTALLATION IS WITHOUT DAMAGE OR DETERIORATION A THE TIME OF SUBSTANTIAL COMPLETION.

5. DISPOSE OF ALL DEBRIS, RUBBISH AND OTHER SIMILAR MATERIALS RESULTING FROM THIS WORK FROM THE PROJECT SITE. TRANSPORT AND LEGALLY DISPOSE OF THIS MATERIAL OFF SITE.

DIVISION 8: OPENINGS

SECTION: 08 14 16: INTERIOR FLUSH WOOD DOORS

GENERAL PROVISIONS:

1. FURNISH THE DOORS, JAMB/FRAMES AND HARDWARE S AS SHOWN ON THE DRAWINGS AND/OR FINISH SCHEDULE. PROVIDE THE PRODUCT DATA FOR THE DOOR CORE AND EDGE CONSTRUCTION. THE VENEER SPECIES, CUT AND SHALL MATCH THE EXISTING DOORS.

CODES AND STANDARDS:

1. THE WOOD DOORS, METAL JAMBS/FRAMES, LOCKSETS AND ACCESSORIES SHALL COMPLY WITH THE APPLICABLE PROVISIONS AND RECOMMENDED PRACTICES OF THE AMERICAN WOODWORK STANDARDS (AWS), QUALITY STANDARDS, SECTION 1300, 2014 EDITION, AND THE WOOD DOOR MANUFACTURER'S ASSOCIATION (WDMA) I.S. 1A-13 INDUSTRY STANDARD FOR INTERIOR ARCHITECTURAL WOOD FLUSH DOORS.

2. PERFORMANCE LEVEL: WDMA HEAVY DUTY

3. PRODUCT CERTIFICATION: PROVIDE DOCUMENTS SHOWING COMPLIANCE TO THE FOLLOWING WDMA DOOR ATTRIBUTES, VALIDATING THE SPECIFIED WDMA PERFORMANCE DUTY LEVEL:

   A. ADHESIVE BONDING DURABILITY: WDMA TM-6
   B. CYCLE SLAM: WDMA TM-7
   C. HINGE LOADING: WDMA TM-8
   D. SCREW HOLDING: WDMA TM-10
      1) DOOR FACE
      2) VERTICAL DOOR EDGE

4. FSC PRODUCTS SHALL BE IDENTIFIED AS SUCH ON A LINE-ITEM BASIS AND SHALL BE INDENTIFIED AS "FSC 100%," "FSC MIX CREDIT," OR "FSC MIX[NN]%." THE VENDOR'S CHAIN OF CUSTODY (COC) NUMBER SHALL BE SHOWN ON ANY INVOICE THAT INCLUDES FSC PRODUCTS.

5. FURNISH AND INSTALL ALL WOOD DOORS, JAMB FRAMES, HARDWARE ATTACHMENT AND ACCESSORIES.

6. DELIVERY AND STORAGE: WHEN DELIVERED TO THE SITE, THE STORAGE OF THE DOORS MUST BE PROTECTED UNDER COVERING AGAINST DAMAGE TO THE PRODUCT. DELIVER MANUFACTURED MATERIALS IN ORIGINAL PACKAGING, CONTAINERS, OR BUNDLES BEARING THE MANUFACTURER'S NAME, BRAND, TYPE AND SIZE.

7. SUBMIT FINISHED DOOR PANEL SAMPLE TO MATCH THE COLOR AND FINISH OF THE EXISTING DOORS ELSEWHERE IN THIS FACILITY.

MATERIALS AND QUALITY CONTROL:

SUBMIT PRODUCT INFORMATION TO THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS FOR APPROVAL.

1. TYPE: FLUSH INTERIOR DOORS, 1-3/4 INCHES THICK, SOLID CORE, 5 PLY CONSTRUCTION WITH WOOD VENEER SUITABLE FOR TRANSPARENT FINISH.

2. CONSTRUCTION: 5 PLIES WITH STILES AND RAILS BONDED TO CORE AND ASSEMBLY SANDED PRIOR TO GLUING CROSSBAND AND FACE VENEER TO EACH SIDE OF CORE. COMPLY WITH AWI SECTION 1300, PC-5, PREMIUM GRADE.

3. BLOCKING: PROVIDE 5 INCHES WIDE MINIMUM WOOD BLOCKING FOR INSTALLATION OF LOCKSETS, CLOSERS, EXIT DEVICES, KICK PLATES, AND OTHER HARDWARE ITEMS AND ELIMINATE NEED FOR THROUGH-BOLTING.

4. STILES: 1-3/8 INCHES MINIMUM HARDWOOD, SAME SPECIES AS FACE VENEER WITH NO VISIBLE JOINTS.

5. TOP AND BOTTOM RAILS: 11/8- INCH MINIMUM SOLID WOOD.

6. WOOD VENEER: ¼" MINIMUM ROTARY CUT WHITE BIRCH, AWS CUSTOM GRADE AA OR WDMA PREMIUM GRADE, SUITABLE FOR TRANSPARENT FINISH, TO MATCH EXISTING DOORS ELSEWHERE IN THE FACILITY.

7. ADHESIVES: THE DOOR VENDOR SHALL PROVIDE DOCUMENTATION THAT THE DOORS CONTAIN NO UREA FORMALDEHYDE FOR ALL ADHESIVES AND COMPOSITE WOOD PRODUCTS.

8. THE DOOR VENDOR SHALL PROVIDE DOCUMENTATION THAT THE DOORS COMPLY FULLY WITH THE TESTING AND PRODUCT REQUIREMENTS OF THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES' "STANDARD PRACTICE FOR THE TESTING OF VOLITILE ORGANIC EMISSIONS FROM VARIOUS SOURCES USING SMALL SCALE ENVIRONMENTAL CHAMBERS."

9. JAMB/FRAME: 14 GAUGE COLD ROLLED STEEL, PAINT TO MATCH EXISTING FRAMES ELSEWHERE IN THE FACILITY. SUBMIT PRODUCT INFORMATION TO THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS FOR APPROVAL.

10. HARDWARE AND ACCESSORIES:

    A. ALL FINISH HARDWARE SHALL BE FURNISHED FOR THE PROJECT. WHERE SPECIFIC HARDWARE MAY NOT BE INDICATED, THE CONTRACTOR AND HARDWARE SUPPLIER

SHALL PROVIDE THE SAME HARDWARE THAT IS REQUIRED FOR SIMILAR DOORS ELSEWHERE AS A PART OF THE PROJECT.

B. HARDWARE SCHEDULE: COORDINATE THE SCHEDULE WITH THE FLOOR PLAN AND DOOR SCHEDULE. THE FOLLOWING DENOTES TYPE AND QUALITY OF THE DOOR HARDWARE. THE CONTRACTOR SHALL PROVIDE A COMPLETE FINAL HARDWARE SCHEDULE LISTING FROM THE HARDWARE SUPPLIER FOR APPROVAL PRIOR TO INSTALLATION, BASED ON THE FOLLOWING:

QTY	ITEM	PRODUCT	DESCRIPTION	FINISH	MFR
HARDWARE GROUP #1: DOORS D01, D02, D03, D04, D05, D06, D07, D08, D10, D11					
1½ PR	HINGES	FBB 191	4½"x4½"x 0.18 GA., 5 KNUCKLE BALL BEARING, STAINLESS STEEL	630	STANLEY
1	LOCKSET	ND70J-CO6D RHO	LEVER TYPE CYLINDER LOCK STAINLESS STEEL	626	SCHLAGE
1	CYLINDER	8000	HOUSING		CORBIN-RUSSWIN
1	KEYWAY	93C1			CORBIN-RUSSWIN
1	STOP	FS438	ALUMINUM FLOOR MOUNT		IVES
HARDWARE GROUP #2: DOOR D13					
1½ PR	HINGES	FBB 191	4½"x4½"x 0.18 GA., 5 KNUCKLE BALL BEARING, STAINLESS STEEL	630	STANLEY
1	LATCHSET	ND105-CO6D RHO	LEVER TYPE STAINLESS STEEL	626	SCHLAGE
1	STOP	FS438	ALUMINUM FLOOR MOUNT		IVES
HARDWARE GROUP #3: DOOR D16 (DOUBLE DOORS @ ELECTRIC PANELS)					
3 PR	HINGES	FBB 191	4½"x4½"x 0.18 GA., 5 KNUCKLE BALL BEARING, STAINLESS STEEL	630	STANLEY
1	LATCHSET	ND105-CO6D RHO	LEVER TYPE STAINLESS STEEL	626	SCHLAGE
1	FLUSH BOLT	SP393-1/2	6-INCH MORTISE SATIN BRASS	605	STANLEY
1	STOP	FS438	ALUMINUM FLOOR MOUNT		IVES

HARDWARE GROUP #4: DOORS D14, D15 (SHOWERS)

1½ PR	HINGES	FBB 191	4½"x4½"x 0.18 GA., 5 KNUCKLE BALL BEARING, STAINLESS STEEL	630	STANLEY
1	PRIVACY	ND405-CO6D RHO	LEVER TYPE STAINLESS STEEL	626	SCHLAGE
1	STOP	FS438	ALUMINUM FLOOR MOUNT		IVES

HARDWARE GROUP #5: DOOR D15 (DOUBLE DOORS @ CONFERENCE ROOM)

2 SETS	BARN DOOR	W100	PEMKO

C. HINGES: 4½"x4½"x 0.18 GA., FIVE (5) KNUCKLE, BALL BEARING, STAINLESS STEEL A5111, US32D (#630) FINISH, NON-REMOVABLE PIN, HEAVY WEIGHT FULL MORTISE HINGE, 1½" PAIR (3 HINGES), 180 DEGREE SWING PER DOOR. SUBMIT PRODUCT INFORMATION TO THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS FOR APPROVAL.

D. LOCKSETS: SCHLAGE # ND70J-CO6D RHO HOUSING, CORBIN-RUSSWIN #8000 CYLINDER, AND #93C1 KEYWAY, 626 FINISH, LEVER TYPE. INSTALL LOCKSETS AT OFFICES (101, 102, 103, 104, 105, 106, 107), AT SECURE STORAGE ROOMS (119, 120, 121, 122, 123).

E. PRIVACY LOCKSETS: SCHLAGE # ND405-CO6D RHO HOUSING, WITH PUSH BUTTON FEATURE, 626 FINISH, LEVER TYPE. INSTALL AT SHOWER AREAS (117 & 118).

F. LATCHSETS: SCHLAGE # ND105-CO6D RHO HOUSING, 626 FINISH, LEVER TYPE. INSTALL AT ROOMS (119, 120, 124)

G. KICK PLATES: 8" HEIGHT x 34" WIDTH (2-INCH LESS THAN DOOR WIDTH) x 0.05" (16 GA.)THICKNESS PER ANSI A156.6, STAINLESS STEEL US32D (#630) FINISH, INSTALLED ON THE "PUSH" SIDE OF THE EXIT DOORS.

H. DOOR CLOSERS (WHERE SHOWN): 180 DEGREE HEAVY DUTY, STAINLESS STEEL US32D (#630) FINISH, SURFACE MOUNT, OVERHEAD, SWING ARM OPERATION, LCN #4040XP-SERIES WITH SH CUSH FUNCTION. SUBMIT PRODUCT INFORMATION TO THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS FOR APPROVAL.

I. DOOR STOPS: IVES #FS438 DOME STOP, FLOOR MOUNT, ALUMINUM, SHIM UP AS REQUIRED TO PREVENT DOOR FROM DAMAGING WALL FINISH.

J. (WHERE SHOWN) INSTALL 3-INCH WIDTH PEMKO #151A x ¼" HT. MILL FINISH ALUMINUM SADDLES AT THRESHOLDS THAT COMPLY WITH DISABILITY REQUIREMENTS. ANCHOR SADDLES INTO THE CONCRETE FLOOR SLABS WITH ¼ -20

x 2" FLAT HEAD SLEEVE ANCHORS PER MANUFACTURER'S INSTRUCTIONS. THE CONTRACTOR MAY SUBMIT ALTERNATE HALF OR OFFSET HEIGHT PEMKO SADDLE FOR APPROVAL.

PERFORMANCE:

1. ALL DOORS AND JAMB FRAMES SHALL BE INSPECTED PRIOR TO INSTALLATION (HANGING). VERIFY FRAMES ARE CORRECT FOR SIZE AND TYPE, SECURELY ANCHORED, HEADS ARE LEVEL, AND JAMBS ARE PLUMB. ALL DOORS AND FRAMES WITH DEFECTS SHALL BE REJECTED. DO NOT PROCEED UNTIL DEFICIENCIES ARE ADDRESSED.

2. INSTALL WOOD DOOR ASSEMBLIES PER AWS CUSTOM AND WDMA PREMIUM QUALITY STANDARDS. NOTE THE DOOR ASSEMBLIES SHALL BE INSTALLED WITH THE APPROPRIATE HARDWARE AND ACCESSORIES.

3. ADJUST ALL DOOR ASSEMBLIES FOR A SMOOTH AND BALANCED MOVEMENT. DOOR ASSEMBLIES THAT DO NOT OPERATE FREELY SHALL BE EITHER RE-INSTALLED OR REPLACED.

4. FINISH: THE TRANSPARENT (STAIN GRADE) FINISH SHALL COMPLY WITH AWS QUALITY STANDARD, SECTION 1500 CUSTOM GRADE AND WDMA STANDARDS. THE APPROVED DOORS SHALL BE:

   A. SANDED SMOOTH, REPAIR ANY IMPERFECTIONS, RE-SANDED AS REQUIRED AND WIPED COMPLETELY FREE OF DUST AND DEBRIS.

   B. APPLY ONE COAT OF MINWAX WOOD FINISH STAIN "COLONIAL MAPLE" #223.

   C. APPLY THE FIRST COAT OF MINWAX POLYURETHANE CLEAR SATIN FINISH. LET DRY FOR 3-4 HOURS.

   D. THEN SAND SMOOTH AND WIPE COMPLETELY FREE OF ANY DUST AND DEBRIS.

   E. APPLY A SECOND COAT OF THE MINWAX CLEAR SATIN FINISH AND ALLOW TO DRY COMPLETELY.

5. SEAL THE EDGES OF DOORS, THE EDGES OF ALL CUT-OUTS, AND MORTISES AFTER FITTING.

6. FINAL APPROVAL OF THE DOOR FINISH SHALL BE PER INSPECTION OF THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS OF VENTURA COLLEGE PRIOR TO ACCEPTANCE OF THE DOORS.

7. FINAL APPROVAL OF THE DOOR HARDWARE AND ACCESSORIES SHALL BE PER INSPECTION OF THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERSTIONS OF VENTURA COLLEGE.

8. PROVIDE PROTECTIONS AS REQUIRED IN ORDER TO PREVENT DIRT, WATER AND ABUSE DAMAGE. STORAGE AND PROTECTION OF DOORS SHALL COMPLY WITH WDMA STANDARDS. THE DOORS SHALL BE STORED FLAT AND OFF THE FLOOR IN A DRY, WELL-VENTILATED BUILDING.

ADJUSTING:

1. CORRECT ANY DEFICIENCY THAT PROHIBITS THE DOOR ASSEMBLIES FROM SWINGING AND/OR OPERATING FREELY.

2. ALIGN AND FIT DOORS IN FRAMES WITH UNIFORM CLEARANCES. PROVIDE ⅛-INCH CLEARANCE AT HEADS, JAMBS, AND BETWEEN PAIRS OF DOORS, WHERE OCCURS.

3. PROVIDE ⅛-INCH CLEARANCE FROM BOTTOM OF DOOR TO THE TOP OF ANY DECORATIVE FLOOR FINISH UNLESS OTHERWISE INDICATED. WHERE A THRESHOLD OR SADDLE IS INDICATED TO BE INSTALLED, THE CLEARANCE SHALL BE ¼-INCH FROM THE BOTTOM OF THE DOOR TO THE TOP OF THE THRESHOLD OR SADDLE, UNLESS OTHERWISE INDICATED. NOTE THE BOTTOM RAIL MAY BE TRIMMED ONLY TO THE EXTENT PERMITTED BY THE LABELING AGENCY.

4. DO NOT REMOVE HINGE SCREWS AFTER INITIAL INSERTION.

5. SHIMS USED FOR ALIGNMENT PURPOSES SHALL BE LIMITED TO INSERTION BETWEEN THE HINGE AND THE FRAME. DO NOT INSERT SHIMS BETWEEN THE HINGE AND DOOR.

6. ENSURE THAT DOOR CLOSERS ARE PROPERLY ADJUSTED AND DO NOT LIMIT THE DOOR OPENING SWING TO PREVENT STILE FAILURE.

7. DOOR CLOSURES SHALL BE 180 DEGREE OPENING TYPE.

8. LIMIT THE DOOR OPENING SWING ONLY WITH A PROPERLY LOCATED DOOR STOP.

DIVISION 8: OPENINGS

SECTION: 08 31 13: ACCESS DOORS AND FRAMES

GENERAL SCOPE:

1. ACCESS DOORS SHALL BE STAINLESS STEEL AT WALL LOCATIONS FOR ACCESS TO PLUMBING VALVES AND WALL CLEAN OUTS AS INDICATED.
2. SUBMIT PRODUCT INFORMATION FOR APPROVAL.

MATERIALS AND CONSTRUCTION:

1. STEEL FRAMES SHALL BE 16 GAUGE STAINLESS STEEL.
2. STEEL DOORS SHALL BE 16 GAUGE STAINLESS STEEL.
3. FRAME FLANGES SHALL BE ONE PIECE CONSTRUCTION AND 1-INCH FACE WIDTH.
4. DOOR AND TRIM SHALL HAVE RADIUSED CORNERS.
5. DOOR HINGE SHALL BE CONCEALED CONTINUOUS PIANO TYPE.
6. LOCKS SHALL BE FLUSH AND KEY OPERATED CYLINDER LOCK WITH DUST SHUTTER.
7. FINISH SHALL BE STAINLESS STEEL. SHIP TO RESTROOM PARTITION COMPANY IN ORDER TO REFINISH THE DOOR AND FRAME ASSEMBLIES TO MATCH THE RESTROOM PARTITION ROTARY BRUSH FINISH.
8. PRODUCT SHALL BE ELMDOR DW 12” X 12”, TYPE 304 NO. 4 SATIN FINISH STAINLESS STEEL, OR EQUAL

EXECUTION OF THE WORK:

1. FRAME IN ROUGH OPENING PER MANUFACTURER’S SPECIFICATIONS
2. PROVIDE PROTECTIONS AS REQUIRED IN ORDER TO PREVENT DAMAGE.

DIVISION 9: FINISHES

SECTION 09 21 17: GYPSUM WALLBOARD

GENERAL PROVISIONS

1. FURNISH AND INSTALL ALL GYPSUM WALLBOARD AS A SUBSTRATE FOR OTHER FOR OTHER FINISH MATERIALS ON ALL INTERIOR WALLS AND ON THE INTERIOR SURFACE PORTIONS OF EXTERIOR WALLS. FURNISH AND INSTALL GYPSUM BOARD SUSPENDED CEILING SURFACES WHERE INDICATED ON THE DRAWINGS WITH HANGERS AND SUPPORTS.

2. FURNISH AND INSTALL FIRE-RATED GYPSUM WALLBOARD AND CEILING BOARD CONSTRUCTION AT LOCATIONS INDICATED ON THE DRAWINGS. THE FIRE RESISTANCE RATINGS FOR WALL AND CEILING ASSEMBLIES SHALL BE AS SHOWN ON THE DRAWINGS.

3. ROUGH CARPENTRY FRAMING SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.

4. QUALITY CONTROL:

   A. GYPSUM BOARD SHALL BE PER ASTM C 11.

   B. ALL GYPSUM WALL BOARD USED IN THE RESTROOMS ABOVE 8-FOOT HEIGHT AND AT CEILING LOCATIONS SHALL BE MOISTURE RESISTANT “PURPLE” BOARD FOR DAMP LOCATIONS. NOTE THAT DUROCK CEMENTITIOUS BACKER BOARD SHALL BE USED AT THE PLUMBING WALLS AND AT THE SHOWER ROOM ENCLOSURES.

   C. GYPSUM DRYWALL SCREWS SHALL BE PER ASTM C 1002 OR ASTM C 954; AND THE HEAD DIAMETER, LENGTH AND SPACING OF THESE SCREWS SHALL EQUAL OR EXCEED THE REQUIREMENTS FOR NAILING.

   D. GYPSUM WALLBOARD AND CEILING BOARD PRODUCTS SHALL BE 5/8” THICKNESSS AND PER CBC 2016 ED., CHAPTER 25, ASTM C 36 AND THE GYPSUM ASSOCIATION.

5. DELIVERY AND STORAGE: WHEN DELIVERED TO THE SITE, THE STORAGE OF GYPSUM WALLBOARD MUST BE PROTECTED UNDER COVERING AGAINST MOISTURE AND DAMAGE TO THE PRODUCT. DELIVER MANUFACTURED MATERIALS IN ORIGINAL PACKAGING, CONTAINERS, OR BUNDLES BEARING THE MANUFACTURER’S NAME, BRAND, TYPE AND SIZE.

MATERIALS:

PROVIDE GYPSUM BOARD PRODUCTS AND ALL RELATED PRODUCTS OF TYPES INDICATED IN MAXIMUM LENGTHS AVAILABLE TO MINIMIZE END JOINTS. THE FOLLOWING MATERIAL NAMES ARE BASED ON THE NATIONAL GYPSUM GOLD BOND "STA-SMOOTH" BEVEL EDGE SYSTEM. MANUFACTURER'S LISTED AS MEMBERS OF THE GYPSUM ASSOCIATION MAY BE USED.

A. WALLS (EXCEPT WHERE SHOWN): 5/8" STA-SMOOTH GYPSUM WALLBOARD

B. WALLS (WHERE SHOWN/NOTED): 5/8" TAPERED EDGE M/R (MOISTURE RESISTANT) GYPSUM WALLBOARD PER ASTM C 630AND "FIRE-SHIELD" TYPE-X GYPSUM WALLBOARD

C. DROPPED CEILING (WHERE SHOWN/NOTED): 5/8" "FIRE SHIELD" TYPE-X GYPSUM BOARD. EDGES: TAPERED / BEVELED

D. GYPSUM BACKING BOARD FOR MULTI-LAYER APPLICATIONS: 5/8" THICK PER ASTM C 442 TYPE-X

E. TRIM ACCESSORIES: MANUFACTURER'S STANDARD TRIM ACCESSORIES, INCLUDING ZINC ALLOY COATED METAL CORNER-BEADS, CASING BEADS AND EDGE TRIM OF BEADED TYPE WITH FACE FLANGES FOR CONCEALMENT WITHIN JOINT COMPOUND, EXCEPT WHERE SEMI-FINISHING OR EXPOSED TYPE IS SHPWN ON THE DRAWINGS PER ASTM C 840.

F. ONE PIECE CONTROL JOINTS ¼" WIDTH BY 7/16" DEPTH VEE-SHAPED SLOT, COVERED WITH REMOVABLE TAPE OF ROLL-FORMED ZINCE COATED METAL OR EXTRUDED VINYL PER GYPSUM BOARD MANUFACTURER'S RECOMMENDATION.

G. JOINT TREATMENT TAPE: PAPER CROSS-FIBERED, PERFORATED, AND FEATHER-EDGED REINFORCING TAPE PER MANUFACTURER'S RECOMMENDATION. NOTE: USE OPEN-WEAVE GLASS FIBER TAPE PER MANUFACTURER WHERE CONDITIONS INDICATE TOGETHER WITH SETTING-TYPE JOINT COMPOUND

H. JOINT COMPOUND: USE FACTORY-PREPACKAGED, READY-MIXED AND FORMULATED FOR THE USES AND LOCATIONS INDICATED

I. MISCELLANEOUS MATERIALS:LAMINATING ADHESIVES SHALL BE PER MANUFACTURER'S RECOMMENDATIONS FOR THE USES AND LOCATIONS INDICATED.

J. FASTENING ADHESIVE FOR WOOD: PER ASTM C 557

K. GYPSUM BOARD SCREWS: PER ASTM C 1002

L. GYPSUM BOARD JOINT TREATMENT MATERIALS SHALL BE PER ASTM C 475 AND ASTM C 840.

VERIFY THE FIRE RATED ASSEMBLY LOCATION AS SHOWN, AND AS REQUIRED BY THE BUILDING CODE.

FASTENERS

1. GWB-54 1-5/8" LENGTH ANNULAR RING SHANK NAILS PER ASTM C-380.

2. 1-1/4" LENGTH TYPE-W DRYWALL SCREWS INTO WOOD FRAMING.

3. 1-1/4" LENGTH TYPE-S DRYWALL SCREWS TO INTERIOR METAL FRAMING.

4. 1-1/4" LENGTH TYPE-S12 CORROSION RESISTANT DRYWALL SCREWS FOR EXTERIOR GYPSUM SHEATHING TO METAL FRAMING.

5. HANGERS AND SUPPORTS: SUBSTITUTION FOR STEEL TRUSS BUILDINGS; 1½" METAL CARRYING CHANNELS, ¾" FURRING CHANNELS, 8 GAUGE HANGER WIRES, 16 GAUGE WIRE TIES AND 1" LENGTH TYPE-S DRYWALL SCREWS.

PERFORMANCE

1. GYPSUM BOARD PRODUCTS SHALL BE CUT BY "SCORING AND BREAKING" OR SAWING, WORKING FROM THE FACE SIDE. SCRIBE NEATLY WHERE THE BOARD ABUTS PROJECTING SURFACES WITH NO IRREGULAR BROKEN EDGES.

2. GYPSUM BOARD SHALL BE INSTALLED AT RIGHT ANGLES TO THE FRAMING MEMBERS. BOARDS OF MAXIMUM PRACTICAL LENGTH SHALL BE USED SO THAT AN ABSOLUTE MINIMUM OF END JOINTS OCCURS. WALLBOARD JOINTS AT OPENINGS SHALL BE LOCATED SO THAT NO END JOINT SHALL ALIGN WITH THE EDGES OF OPENINGS.

3. STAGGER END JOINTS.

4. ATTACH GYPSUM BOARDS WITH DRYWALL SCREWS SPACED IN WOOD FRAMING AT 8-INCH CENTERS MAXIMUM AND IN METAL FRAMING AT 12-INCH CENTERS MAXIMUM. THE HEADS SHALL BE SLIGHTLY BELOW THE SURFACE OF THE BOARD SURFACE IN A

DIMPLE. ENSURE THAT THE SCREWS ARE SUFFICIENTLY FAR ENOUGH FROM THE EDGES TO PREVENT BREAKING THE BOARD(S).

5. FINISHING JOINTS: APPLY THE JOINT COMPOUND, QUICK TREAT, AND TOPPING COMPOUND SHALL BE APPLIED PER MANUFACTURER'S INSTRUCTIONS. FIRST, APPLY A THIN LAYER OF JOINT COMPOUND OVER THE JOINT AND UNDER THE TAPE TO PROVIDE THE PROPER BOND. CEILING ANGLES, WALL ANGLES, AND INSIDE CORNER ANGLES SHALL BE REINFORCED WITH THE TAPE FOLDED TO CONFORM TO THE ANGLE AND EMBEDDED WITHIN THE JOINT COMPOUND.
SECOND, AFTER THE COMPOUND IS THOROUGHLY DRY, APPROXIMATELY TWENTY FOUR (24) HOURS FOR REGULAR COMPOUND, OR 2½ HOURS FOR QUICK-TREAT COMPOUND, THE JOINT TAPE SHALL BE COVERED WITH A COAT OF JOINT COMPOUND OR TOPPING COMPOUND SPREAD OVER THE TAPE APPROXIMATELY 3-INCH WIDTH ON EACH SIDE OF THE TAPE, AND THEN FEATHERED OUT FROM THE EDGE OF THE TAPE.

LASTLY, AFTER THE FOREGOING APPLICATION IS THOROUGHLY DRY, APPLY ANOTHER CROWN COAT OVER THE JOINTS. THIS COAT SHALL BE SMOOTH WITH THE EDGES FEATHERED OUT APPROXIMATELY 3-INCH WIDTH BEYOND THE PRECEEDING COAT OF COMPOUND.

ALLOW EACH APPLICATION OF JOINT COMPOUND TO JOINTS AND SCREW HEADS TO DRY THOROUGHLY, AND THEN SAND SMOOTH.

ALL WALLBOARD AND CEILING BOARD APPLICATIONS SHALL BE SMOOTH AND READY FOR PAINTING OR WALL COVERING FINISHES.

DIVISION 09

SECTION 09 28 13: CEMENTITIOUS BACKING BOARD

GENERAL PROVISIONS

1. FURNISH AND INSTALL ALL CEMENTITIOUS BACKING BOARD AS A SUBSTRATE FOR OTHER FINISH MATERIALS ON THE INTERIOR RESTROOM WALLS WHERE INDICATED.

2. THIS IS RELATED TO THE ROUGH CARPENTRY FRAMING, AND SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.

3. QUALITY CONTROL:

   A. CEMENTITIOUS BACKING BOARD INSTALLATION SHALL BE PER ASTM C 1325 AND ANSI A118.9.

   B. BACKING BOARD SCREWS INTO WOOD STUD FRAMING SHALL BE PER MANUFACTURER'S RECOMMENDATION FOR HEAD DIAMETER, LENGTH AND SPACING, AND PER ASTM C 1002

   C. THE PRODUCT SHALL BE UNITED STATES GYPSUM COMPANY "DUROCK" © CEMENT BOARD, OR HARDIEBACKER© , ½" THICKNESS.

   D. THE RECOMMENDED SPECIFICATION FOR THE APPLICATION OF WALL SHEATHING SHALL BE PER THE GYPSUM ASSOCIATION GA-253.

4. ALL MATERIALS SHALL BE DELIVERED IN THEIR ORIGINAL UNOPENED PACKAGING, AND STORED IN AN ENCLOSED SHELTERED AREA THAT PROVIDES PROTECTION FROM DAMAGE AND EXPOSURE FROM THE ELEMENTS. DUROCK © BRAND CEMENT BOARD SHALL BE STORED FLAT SO AS NOT TO CAUSE SERIOUS INJURY.

5. TRIM ACCESSORIES SHALL BE MANUFACTURER'S STANDARD TRIM ACCESSORIES; INCLUDING ZINC ALLOY COATED METAL CORNER-BEADS, CASING BEADS AND EDGE TRIM OF BEADED TYPE WITH FACE FLANGES FOR CONCEALMENT WITHIN JOINT COMPOUND, EXCEPT WHERE SEMI-FINISHING OR EXPOSED TYPE IS SHOWN ON THE DRAWINGS PER ASTM C 840.

6. FASTENERS: DUROCK © BRAND WOOD OR USG SHEATHING "WF" SCREWS 1¼" LENGTH WITH CORROSION RESISTANT COATING.

INSTALLATION

1. DO NOT USE MATERIALS WITH DEFECTS THAT IMPAIR THE QUALITY OF THE SHEATHING OR PIECES THAT ARE TOO SMALL TO USE WITH THE MINIMUM NUMBER JOINTS, OR THE OPTIMUM JOINT ARRANGEMENT.

2. CUT PANELS AT PENETRATIONS, EDGES, AND OTHER OBSTRUCTIONS OF WORK; FIT TIGHTLY AGAINST ABUTTING CONSTRUCTION, UNLESS OTHERWISE INDICATED.

3. COORDINATE WALL SHEATHING INSTALLATION WITH FLASHING AND JOINT-SEALANT INSTALLATION SO THESE MATERIALS ARE INSTALLED IN SEQUENCE AND MANNER THAT PREVENT EXTERIOR MOISTURE FROM PASSING THROUGH COMPLETED ASSEMBLY.

4. DO NOT BRIDGE BUILDING EXPANSION JOINTS. CUT AND SPACE EDGES OF PANELS TO MATCH SPACING OF STRUCTURAL SUPPORT ELEMENTS.

5. COMPLY WITH ASTM C 1280, GA-253 AND MANUFACTURER'S WRITTEN INSTRUCTIONS.

   A. INSTALL BOARDS WITH A 3/8-INCH GAP WHERE NON-LOAD-BEARING CONSTRUCTION ABUTS STRUCTURAL ELEMENTS.

   B. INSTALL BOARDS WITH A 1/4-INCH GAP WHERE THEY ABUT MASONRY OR SIMILAR MATERIALS THAT MIGHT RETAIN MOISTURE, TO PREVENT WICKING.

   C. APPLY FASTENERS SO HEADS BEAR TIGHTLY AGAINST FACE OF SHEATHING BOARDS BUT DO NOT CUT INTO FACING.

6. HORIZONTAL INSTALLATION:

   A. ABUT ENDS OF BOARDS OVER CENTERS OF STUDS, AND STAGGER END JOINTS OF ADJACENT BOARDS NOT LESS THAN ONE STUD SPACING. ATTACH BOARDS AT PERIMETER AND WITHIN FIELD OF BOARD TO EACH STUD.

   B. SPACE FASTENERS APPROXIMATELY 8 INCHES O.C. AND SET BACK A MINIMUM OF 3/8 INCH FROM EDGES AND ENDS OF BOARDS.

   C. FOR SHEATHING UNDER STUCCO CLADDING, BOARDS MAY BE INITIALLY TACKED IN PLACE WITH SCREWS IF OVERLYING SELF-FURRING METAL LATH IS SCREW-ATTACHED THROUGH SHEATHING TO STUDS IMMEDIATELY AFTER SHEATHING IS INSTALLED.

7. CEMENTITIOUS FIBER-MAT REINFORCED SHEATHING: A CONTINUOUS 6 MIL POLYETHYLENE WATER BARRIER MUST BE INSTALLED OVER THE STUDS AND LAP OVER THE FLASHING. WEEPS MUST BE PROVIDED TO ALLOW WATER DRAINAGE OUT OF THE SYSTEM AT ALL HORIZONTAL TERMINATIONS.

8. INSTALL PER TILE COUNCIL OF AMERICA DETAIL #W244C-16, 2016 EDITION.

DIVISION 9: FINISHES

SECTION 09 31 00: PORCELAIN CERAMIC TILE

GENERAL PROVISIONS

1. FURNISH AND INSTALL ALL CERAMIC TILE FLOORING AND TILE WALL COVERING.

2. TILE AND TILE INSTALLATION SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.

3. QUALITY CONTROL:

   ALL TILE MATERIALS, MORTAR AND ACCESSORIES SHALL COMPLY WITH THE RECOMMENDED PRACTICES OF THE TILE COUNCIL OF AMERICA (TCA), HANDBOOK FOR CERAMIC TILE INSTALLATION, 2016 EDITION, AND ANSI A 108 AND A 118 SPECIFICATIONS FOR THE WORK SHOWN ON THE DRAWINGS.

4. STATIC COEFFICIENT OF FRICTION: TILE ON WALKING SURFACES SHALL COMPLY WITH ASTM C 1028, AND AS FOLLOWS:

   A. LEVEL SURFACES: 0.6 (WET) MINIMUM
   B. STEP TREADS: 0.6 (WET) MINIMUM
   C. RAMP SURFACES: 0.8 (WET) MINIMUM

5. SUBMIT SAMPLE MOCK-UP TO THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS OF VENTURA COLLEGE FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK.

6. DELIVERY AND STORAGE: WHEN DELIVERED TO THE SITE, THE STORAGE OF THE TILE AND TILE PRODUCTS MUST BE PROTECTED UNDER COVERING AGAINST DAMAGE TO THE PRODUCT. DELIVER MANUFACTURED MATERIALS IN ORIGINAL PACKAGING, CONTAINERS, OR BUNDLES BEARING THE MANUFACTURER'S NAME, BRAND, TYPE AND SIZE.

MATERIALS:

1. FURNISH PORCELAIN TILE AS SHOWN ON THE DRAWINGS AND/OR FINISH SCHEDULE. FURNISH ALL TRIM SHAPES OF THE SAME MATERIAL COLOR AND TEXTURE AS FIELD TILES INCLUDING TOP, BOTTOM AND CORNER PIECES.

2. PORCELAIN WALL TILE: ROCA PURE GREY PORCELAIN TILE 12" x 24", BUENA TILE CO.

3. PORCELAIN FLOOR TILE (IF APPLICABLE): MARAZZI "MODERN OASIS", 2"x2" MOSAIC, GENTLE RAIN, BUENA TILE CO.

4. ACCESSORIES

   A. WALLS: SCHLUTER "SCHIENE" #10 (3/8"), STAINLESS STEEL AT VERTICAL EDGES
   B. FLOORS: SCHLUTER "DILEX-HKUE", STAINLESS STEEL AT COVE BASE WHERE ABUTS TILE FLOOR, OR "DILEX-AHKA" WHERE ABUTS SEALED CONCRETE FLOOR SLAB, AND "DILEX-HKUR" AT BASE COVE CORNERS
   C. FLOOR MEMBRANE UNDER TILED FLOOR WHERE APPLICABLE: CUSTOM "REDGARD" WATERPROOF AND CRACK ISOLATION
   D. WET WALLS AND SHOWER WALLS: DUROCK © OR HARDIEBACKER © WITH 6-MIL POLYETHYLENE MOISTURE BARRIER AT STUDS
   E. THE SCHLUTER ACCESSORIES SHALL BE A BRUSHED NICKEL FINISH

5. CEMENTITIOUS TILE BACKER BOARD SHALL BE ½" DUROCK ©, OR HARDIEBACKER ©, NAILABLE CONCRETE TILE BACKER BOARD. INSTALL WITH 1¼" SUPERIOR-BILT BACKER BOARD SCREWS AT 8-INCHES ON CENTER. INSTALL PER TILE COUNCIL OF AMERICA DETAIL #W244C-16.

6. GROUT PER ANSI 118.6 AND 118.7:

   A. JOINTS IN FLOORING TILES AND AT BASE TILES SHALL BE A POLYBLEND SANDED EPOXY TILE GROUT. THE GROUT COLOR SHALL BE TEC "ADVANCED PERFORMANCE" #934 DELOREAN GRAY, SUBMIT SAMPLE FOR APPROVAL.

   B. JOINTS IN WALL TILES SHALL BE A POLYBLEND SANDED EPOXY TILE GROUT. THE GROUT COLOR SHALL BE TEC "ADVANCED PERFORMANCE" #940, ANTIQUE WHITE.

7. GROUT SEALANT: AQUA MIX PENETRATING SEALER

8. TROWEL APPLIED THIN-SET MORTAR SHALL BE LATEX-PORTLAND CEMENT MORTAR BOND COAT PER ANSI 118.4.

PERFORMANCE

1. VERIFY THAT WALL SURFACES ARE FREE OF SUBSTANCES WHICH WOULD IMPAIR BONDING OF SETTING MATERIALS, SMOOTH AND FLAT WITHIN TOLERANCES SPECIFIED IN ANSI A137.1, AND ARE READY TO RECEIVE TILE.

2. JOINTS IN WALL TILE SHALL BE GROUTED WITH JOINT FILLER PER MANUFACTURER'S INSTRUCTIONS AND SHALL BE DAMP CURED. CLEAN TILE O SURFACE GROUT AS WORK PROCEEDS USING DRY GROUT AND BURLAP CLOTH. NO ACID CLEANER SHALL BE USED.

3. VERIFY THAT SUB-FLOOR SURFACES ARE DUST-FREE, AND FREE OF SUBSTANCES WHICH WOULD IMPAIR BONDING OF SETTING MATERIALS TO SUB-FLOOR SURFACES, AND ARE SMOOTH AND FLAT WITHIN TOLERANCES SPECIFIED IN ANSI A137.1.

4. VERIFY THAT CONCRETE SUB-FLOOR SURFACES ARE READY FOR TILE INSTALLATION BY TESTING FOR MOISTURE EMISSION RATE AND ALKALINITY; OBTAIN INSTRUCTIONS IF TEST RESULTS ARE NOT WITHIN LIMITS RECOMMENDED BY TILE MANUFACTURER AND SETTING MATERIALS MANUFACTURER.

5. VERIFY THAT ANY REQUIRED FLOOR-MOUNTED UTILITIES ARE IN CORRECT LOCATION.

6. SEAL ALL SUBSTRATE SURFACE CRACKS WITH FILLER. LEVEL THE EXISTING SUBSTRATE TO ACCEPTABLE FLATNESS TOLERANCES.

7. INSTALL THE DUROCK© OR HARDIEBACKER © CEMENTITIOUS BACKER BOARD PER ANSI A108.11 AND THE BOARD MANUFACTURER'S INSTRUCTIONS. TAPE ALL JOINTS AND CORNERS, AND COVER WITH A SKIM-COAT OF DRY-SET MORTAR TO A FEATHER EDGE.

8. VERTICAL WALLS OVER CEMENTITIOUS BACKER BOARD: INSTALL PER TCA METHOD W244C FOR DRY-SET MORTAR, 1/8"-3/16" WIDTH JOINT

9. INTERIOR CONCRETE SUBSTRATE: INSTALL PER TCA METHOD F122 FOR THINSET MORTAR, 3/16" WIDTH JOINT. JOINTS SHALL BE FILLED AND FLUSH WITH THE SHOULDER OF THE TILE AND TOOLED TO A SMOOTH DENSE FINISH.

10. GENERIC MOVEMENT JOINTS IN WALL TILE, TILE FLOOR AND BASE SHALL BE INSTALLED PER TCA METHOD EJ171F.

11. APPLY THE AQUA MIX SEALER THE ENTIRE TILE INSTALLATION, BOTH WALLS AND FLOORS. PAY PARTICULAR ATTENTION WHERE SURFACES ABUT.

CLEANING AND PROTECTION:

1. REPLACE ALL DAMAGED WORK WHICH CANNOT BE SATISFACTORILY REPAIRED, RESTORED OR CLEANED, TO THE SATISFACTION OF THE OWNER AT NO COST TO OWNER.

2. REMOVE ALL EXCESS GROUT AND OTHER MATERIALS FROM THE VISIBLE TILE SURFACES.

3. CLEAN TILE AND GROUT SURFACES IN ACCORDANCE WITH MANUFACTURER'S "CARE AND MAINTENANCE INSTRUCTIONS".

4. PROVIDE PROTECTIVE COVERINGS TO PREVENT PHYSICAL DAMAGE FOLLOWING THE INSTALLATION FOR THE DURATION OF THE PROJECT.

5. FULLY PROTECT THE TILE SURFACES FROM DAMAGE UNTIL THE DATE OF SUBSTANTIAL COMPLETION OF THE WORK.

DIVISION 09: SUSPENDED ACOUSTICAL CEILINGS

SECTION: 09 50 00: SUSPENDED ACOUSTICAL CEILINGS

GENERAL PROVISIONS

1. FURNISH THE SUSPENDED ACOUSTICAL CEILING SYSTEM IN ACCORDANCE WITH THE PLANS AND DETAILS AS SHOWN ON THE DRAWINGS. SUBMIT THE PRODUCT DATA FOR THE COMPLETE SYSTEM PRIOR TO ANY APPROVAL AND INSTALLATION.
2. ACCEPTABILITY OF A PROPOSED SUSPENDED ACOUSTICAL CEILING SYSTEM IS CONTINGENT UPON THE ARCHITECT'S REVIEW OF THE PROPOSAL FOR ACCEPTABILITY OF THE APPROVED PRODUCTS.
3. THIS SECTION SHALL INCLUDE THE ACOUSTICAL LAY-IN CEILING PANELS, EXPOSED METAL GRID SUSPENSION SYSTEM, ALL WIRES, FASTENERS, MAIN RUNNERS, CROSS TEES, WALL ANGLE MOLDINGS AND PERIMETER TRIM
4. THE SUSPENDED ACOUSTICAL CEILING SYSTEM SHALL BE SUITABLE TO SUPPORT THE WEIGHT OF THE CEILING PANELS, LIGHTING FIXTURES, HVAC AIR TERMINALS, MISCELLANEOUS SERVICE ASSEMBLIES AND ALL OTHER SUCH ITEMS, NOT HEREIN MENTIONED, WHICH ARE TO BE SUPPORTED BY THE SUSPENDED CEILING SYSTEM.
5. THE SYSTEM SHALL BE CONTINUOUS FROM WALL SURFACE TO WALL SURFACE WITHIN EACH ROOM OR HALLWAY AS SHOWN ON THE DRAWINGS.
6. THE DEFLECTION OF ANY COMPONENT OF THE SUSPENSION SYSTEM SHALL NOT EXCEED 1/360 OF THE SPAN.

QUALITY CONTROL:

1. PROVIDE GRID SUSPENSION SYSTEM COMPONENTS, ACOUSTICAL LAY-IN TILES AND ALL OTHER COMPONENTS BY A SINGLE MANUFACTURER, ENSURING SINGLE-SOURCE RESPONSIBILITY.
2. THE SUSPENSION SYSTEM SHALL MEET ASTM E 580 FOR SEISMIC RESTRAINT.
3. THE ENTIRE ASSEMBLY SHALL MEET ASTM C 423 FOR SOUND ABSORPTION AND SOUND ABSORPTION COEFFICIENTS. THE ENTIRE ASSEMBLY SHALL MEET ASTM E 111 FOR MEASURING INTERZONE SOUND ATTENUATION, AND ASTM E 1414 FOR AIRBORNE SOUND ATTENUATION BETWEEN ROOMS SHARING A COMMON CEILING PLENUM.
4. THE ENTIRE ASSEMBLY SHALL MEET ASTM E 84 FOR SURFACE BURNING CHARACTERISTICS AND ASTM E 1264 CLASSIFICATION.
5. THE ENTIRE ASSEMBLY SYSTEM SHALL MEET ASTM C 636 FOR THE INSTALLATION OF METAL CEILING SUSPENSIONS YSTEMS FOR ACOUSTICAL TILE AND LAY-IN PANELS.
6. LIGHTING FIXTURE ATTACHMENTS SHALL FULLY SUPPORT 100% OF THE LIGHTING FIXTURE WEIGHT ACTING IN ANY DIRECTION.

7. COORDINATE FULLY WITH WITH ALL RELATED TRADES: GYPSUM BOARD, LIGHTING FIXTURES, HVAC MECHANICAL SYSTEMS, ELECTRICAL SYSTEMS, COMMUNICATION AND DATA SYSTEMS, FIRE ALARM SYSTEM, INSULATION AND SPRINKLER SYSTEMS.
8. ENSURE THAT THE ENTIRE SUSPENDED CEILING SYSTEM DOES NOT OBSTRUCT OR SKEW THE PLANNED FIRE SPRINKLER WATER DISTRIBUTION SYSTEM IN ANY WAY. THERE SHALL BE NO DELAY OR ACCELARATED ACTIVATION OF THE FIRE SPRINKLER SYSTEM OR FIRE DETECTION SYSTEM BY EITHER CHANNELING HEAT FROM A FIRE TOWARD OR AWAY FROM THE FIRE SPRINKLER SYSTEM DEVICE.
9. PROTECT FROM DAMAGE THE EXISTING ADJACENT FINISH WORK THAT IS TO REMAIN IN PLACE AND BECOMES EXPOSED DURING THE INSTALLATION PROCESS.

SUBMITTALS:

1. MANUFACTURER'S DESCRIPTIVE DATA AND INSTALLATION INSTRUCTIONS SHOWING ALL SUPPORTING DETAILS, INCLUDING: LATERAL FORCE BRACING, PARTITION BRACING, RUNNER AND PANEL LAYOUTS, AND LIGHTING FIXTURE ATTACHMENTS.

DELIVERY, STORAGE AND HANDLING:

1. DELIVER ALL SUSPENDED ACOUSTICAL CEILING SYSTEM PRODUCTS TO THE JOB SITE IN ORIGINAL UNOPENED PACKAGING.
2. STORE ALL COMPONENTS IN A FULLY ENCLOSED INTERIOR SPACE WHERE THESE WILL BE PROTECTED AGAINST DAMAGE, MOISTURE, DIRECT SUNLIGHT, SURFACE CONTAMINATION AND ANY OTHER CAUSES.
3. PRIOR TO INSTALLATION OF THE ACOUSTICAL TILE UNITS, ALLOW THE TILES TO REACH ROOM TEMPERATURE AND A STABILIZED MOISTURE CONTENT PER THE MANUFACTURER'S INSTRUCTIONS.
4. AVOID CHIPPING THE EDGES OR DAMAGING THE TILES AND OTHER COMPONENTS IN ANY WAY.
5. EXPOSE WALL AND CEILING FINISH IN ORDER TO RE-ROUTE THE UTILITY LINES TO THE NEW LOCATIONS AS SHOWN ON THE DRAWINGS.

PRODUCTS:

1. CHICAGO METALLIC™ 4000 TEMPRA™ 9/16" EXPOSED 24" x 24" GRID (ICC 2631) INTERMEDIATE DUTY CEILING SUSPENSION SYSTEM, FLAME SPREAD CLASS A AND SUITABLE FOR GENERAL AREAS, COMPLETE WITH ALL COMPONENTS. COLOR: WHITE
2. ROCKFON™ SQUARE TEGULAR NARROW SLN ACOUSTIC TILE 24" x 24." COLOR: WHITE
3. FEATURE SUSPENDED WOOD GRILLE: 12"x96"x2¼" ARMSTRONG WOODWORKS GRILLE #7265 – (6)-5/8" x 2¼" WOOD SLATS (MAPLE) WITH DOWELS AND PRELUDE XL SUSPENSION SYSTEM (BLACK).

4. ACCESSORY ASSEMBLY DEVICES: SPLICES, INTERSECTION CONNECTORS AND EXPANSION DEVICES PER THE MANUFACTURER'S INSTRUCTIONS FOR A COMPLETE INSTALLATION
5. UPON COMPLETION OF THE WORK THE CONTRACTOR SHALL DELIVER AN ADDITIONAL 5% OF THE ACOUSTIC TILES AND 2% OF THE SUSPENSION SYSTEM COMPONENTS OF THE AMOUNT INSTALLED TO THE PROJECT SITE IN AN ORIGINAL UNOPENED PACKAGE.

INSTALLATION:

1. FULLY EXAMINE ALL ADJOINING TRADE INSTALLATIONS, AND SUBSTRATES AND STRUCTURAL FRAMING TO WHICH THE SUSPENDED ACOUSTICAL CEILING SYSTEM ATTACHES AND ABUTS. DO NOT PROCEED WITH THE INSTALLATION UNTIL ALL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.
2. MEASURE EACH CEILING AEA TO ESTABLISH THE LAYOUT OF THE ACOUSTICAL UNITS AND TO BALANCE THE BORDER WIDTHS AT OPPOSITE EDGES OF EACH RESPECTIVE CEILING. AVOID THE USE OF LESS-THAN-HALF-WIDTH UNITS AT THE BORDERS WHILE COMPLYING WITH THE CEILING PLAN.
3. FOLLOW THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
4. MITER THE CORNERS OF PERIMETER WALL MOLDINGS AT INTERSECTIONS OR INSTALL CORNER CAPS.
5. INSTALL THE HANGERS PLUMB AND FREE FROM CONTACT WITH INSULATION OR ANY OTHER OBJECTS WITHIN THE CEILING PLENUM THAT ARE NOT A PART OF THE SUPPORTING STRUCTURAL OR CEILING SUSPENSION SYSTEM.
6. SPLAY HAGERS ONLY WHERE REQUIRED AND TO AVOID ANY OBSTRUCTIONS.
7. OFFSET RESULTING HORIZONTAL FORCES BY BRACING, COUNTER-SPLAYING OR OTHER MEANS EFFECTIVE MEANS AS SHOWN ON THE DRAWINGS.
8. WHERE THE WIDTH OF HVAC DUCTS AND OTHER CONSTRUCTION WITHIN THE CEILING PLENUM INTERFERES WITH THE HANGER SPACING, INSTALL SUPPLEMENTAL SUSPENSION MEMBERS AND SYSTEM MEMBERS. NOTE THE SUPPLEMENTAL MEMBERS AND HANGERS SHALL COMPLY FULLY WITH ALL PERFORMANCE LIMITS AS ESTABLISHED BY THE REFERENCED STANDARDS.
9. SECURE THE WIRE HANGERS BY LOOPING AND WIRE-TYING, EITHER DIRECTLY TO STRUCTURES OR TO INSERTS, EYE-SCREWS, OR OTHER DEVICES THAT ARE SECURE AND AND APPROPRIATE FOR THE SUBSTRATE, AND IN A MANNER THAT WILL NOT CAUSE A FAILURE DUE TO AGE, CORROSION, HIGH TEMPERATURE, OR OTHER CAUSE.
10. INSTALL PERIMETER EDGE TRIM PIECES AS SHOWN ON THE DRAWINGS, WHERE NECESSARY TO CONCEAL THE EDGES OF ACOUSTIC TILE EDGES AND WHERE NECESSARY TO COMPLY WITH ALL BUILDING CODE REQUIREMENTS.

CLEAN-UP AND REPAIR

1. DISPOSE OF ALL DEBRIS, RUBBISH AND OTHER SIMILAR MATERIALS RESULTING FROM THIS WORK FROM THE PROJECT SITE. TRANSPORT AND LEGALLY DISPOSE OF THIS MATERIAL OFF SITE.
2. CLEAN ALL EXPOSED SURFACES OF THE ENTIRE CEILING SYSTEM, INCLUDING TRIM PIECES, EDGE MOLDINGS AND ALL OTHER ACCESSORIES.
3. FULLY COMPLY WITH THE MANUFACTURER'S INSTRUCTIONS FOR CLEANING.
4. TOUCH-UP MINOR FINISH IMPERFECTIONS PER THE MANUFACTURER'S INSTRUCTIONS.
5. REMOVE AND REPLACE ANY AND ALL WORK THAT CANNOT BE SUCCESSFULLY CLEANED AND REPAIRED IN ORDER TO PERMANENTLY ELIMINATE ANY EVIDENCE OF DAMAGE OR IMPERFECTION.

DIVISION 9: FINISHES

SECTION 09 91 23: INTERIOR PAINTING

GENERAL PROVISIONS

1. FURNISH ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY FOR THE PROPER PAINTING AND FINISHING OF THE PROJECT.

2. THIS SECTION INCLUDES SURFACE PREPARATION OF THE SUBSTRATES AND THE APPLICATION OF THE PAINT ON THE SUBSTRATES.

3. VERIFY COLOR AS SHOWN ON THE DRAWINGS, OR AS DIRECTED BY THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS OF VENTURA COLLEGE.

MATERIALS:

1. FURNISH THE PAINT BRAND AND COLOR AS SHOWN ON THE DRAWINGS.

2. FURNISH EXTRA MATERIALS FROM THE SAME PRODUCT RUN THAT MATCHES THE PRODUCTS INSTALLED. THESE EXTRA PRODUCTS SHALL BE PACKAGED WITH A PROTECTIVE COVERING FOR STORAGE, AND SHALL DISPLAY THE IDENTIFYING LABEL THAT DESCRIBES THE CONTENTS.

3. UNSPECIFIED BRANDS OF MATERIALS SUCH AS SHELLAC, TURPENTINE, PAINT THINNER, AND SIMILAR MATERIALS SHALL BE PURE AND OF THE BEST QUALITY OBTAINABLE.

4. ALL MATERIALS SHALL BE USED WITHOUT ALTERATION.

5. PUTTY, FILLERS, AND METHOD OF APPLICATION SHALL BE AS RECOMMENDED BY THE MANUFACTURER.

6. CAULKING MATERIAL SHALL BE MONO ACRYLIC TERPOLYMER SEALANT, WHITE COLOR, AND SHALL BE APPROVED BY VENTURA COUNTY COMMUNITY COLLEGE DISTRICT.

PRODUCTS:

1. PROVIDE PAINT PRODUCTS FROM DUNN-EDWARDS CORP. THAT IS CONSISTENT WITH WHAT IS USED THROUGHOUT THE VENTURA COUNTY COMMUNITY COLLEGE CAMPUS.

2. PAINT PRODUCTS SHALL COMPLY FULLY WITH MASTER PAINT INSTITUTE (MPI) STANDARDS.

3. PROVIDE MATERIALS FOR USE WITHIN EACH RESPECTIVE PAINT SYSTEM THAT ARE COMPATIBLE WITH ONE ANOTHER AND WITH THE SUBSTRATES INDICATED UNDER THE CONDITIONS OF SERVICE AND APPLICATION AS NOTED BY THE MANUFACTURER.

4. FOR EACH COAT IN A PAINT SYSTEM, PROVIDE THE PRODUCTS RECOMMENDED IN THE MANUFACTURER'S SPECIFICATIONS FOR THE TOP COAT.

5. ALL PAINT SYSTEM PRODUCTS SHALL COMPLY WITH THE LIMITS FOR THE VOLATIVE ORGANIC COMPOUNDS (VOC) PER THE CALIFORNIA BUILDING CODE AND THE CALIFORNIA GREEN BUILDING CODE.

A. FLAT PAINTS & COATINGS	50 g/L
B. NON-FLAT PAINTS & COATINGS	150 g/L
C. DRY-FOG COATINGS	400 g/L
D. PRIMERS, SEALERS & UNDERCOATINGS	200 g/L
E. ANTI-CORROSIVE & ANTI-RUST PAINTS (FERROUS)	250 g/L
F. ZINC-RICH INDUSTRIAL MAINTENANCE PRIMERS	340 g/L
G. PRE-TREATMENT WASH PRIMERS	420 g/L
H. FLOOR COATINGS	100 g/L
I. CLEAR SHELLACS	730 g/L
J. PIGMENTED SHELLACS	550 g/L

6. THE FOLLOWING LOW-EMITTING INTERIOR PAINTS AND COATINGS SHALL COMPLY WITH THE REQUIREMENTS OF THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES "STANDARD PRACTICE FOR THE TESTING OF VOLATIVE ORGANIC EMISSIONS FROM VARIOUS SOURCES USING SMALL-SCALE ENVIRONMENTAL CHAMBERS."

   A. PRIMER FOR GYPSUM BOARD: DUNN-EDWARDS, ULTRA-GRIP PREMIUM UGPR00 – ACRYLIC INTERIOR PER MPI STD. #17
   B. PRIMER FOR INTERIOR WOOD: DUNN-EDWARDS, ULTRA-GRIP PREMIUM UGPR00 – ACRYLIC INTERIOR PER MPI STD. #17
   C. PRIMER FOR FERROUS METAL: DUNN-EDWARDS, ULTRA-GRIP PREMIUM UGPR00 – ACRYLIC INTERIOR PER MPI STD. #17
   D. INTERIOR PAINT FOR INTERMEDIATE COAT AND TOP COAT: DUNN-EDWARDS SPARTAWALL SWLL30 WATER BASED LATEX ACRYLIC COPOLYMER INTERIOR EGGSHELL (GLOSS LEVEL 3) PER MPI STD # 52

7. FLOOR COATINGS:

   A. CONCRETE FLOOR STAIN SHALL BE PER MPI STD #58
   B. WATER-BASED CONCRETE FLOOR SEALER SHALL BE PER MPI STD #99
   C. SOLVENT-BASED CONCRETE FLOOR SEALER SHALL BE PER MPI STD #104
   D. LATEX CONCRETE FLOOR PAINT LOW GLOSS (GLOSS LEVEL 3) SHALL BE PER MPI STD # 60
   E. ALKYD ENAMEL CONCRETE FLOOR PAINT GLOSS (GLOSS LEVEL 6) SHALL BE PER MPI STD #27

PERFORMANCE:

1. WORKMANSHIP: ALL SURFACES TO BE PAINTED SHALL BE CLEAN AND FREE OF DIRT, DUST, OR GRIT BEFORE PAINTING IS STARTED. PAINTING SHALL NOT BE DONE WHEN THERE IS SWEEPING OR EXCESSIVE DUST IN THE AIR. ALL PITCH STREAKS, RESIN, SPOTS, ETC. SHALL BE CLEANED OF ALL RESIDUE AND TOUCHED UP WITH SHELLAC BEFORE PAINTING.

2. PAINTS SHALL BE APPLIED IN ORDER TO PRODUCE A FINISHED SURFACE FILM THAT IS WITHOUT ANY CLOUDINESS, SPOTTING, HOLIDAYS, LAPS, BRUSH MARKS, ROLLER TRACKING, RUNS, SAGS, ROPINESS, OR OTHER SURFACE IMPERFECTIONS. CUT IN SHARP LINES AND COLOR BREAKS.

3. COMPLY WITH THE MANUFACTURER'S INSTRUCTIONS AND WITH THE PROVISIONS IN THE MASTER PAINT INSTITUTE (MPI) MANUAL.

4. EACH UNDERCOAT SHALL BE TINTED A LIGHTER SHADE TO FACILITATE THE IDENTIFICATION OF EACH COAT. THIS LIGHTER SHADE SHALL BE OF SUFFICIENT DIFFERENCE IN SHADE OF UNDERCOATING IN ORDER TO DISTINGUISH EACH SEPARATE COAT.

5. SHOULD THE UNDERCOATS OR OTHER CONDITIONS SHOW THROUGH THE TOP COAT, ADDITIONAL COATS OF PAINT SHALL BE APPLIED UNTIL THE CURED FILM HAS A UNIFORM PAINTED FINISH, COLOR AND APPEARANCE.

6. MAXIMUM MOISTURE CONTENT OF SUBSTRATES:

   A. CONCRETE: 12%
   B. MASONRY (CMU AND CLAY): 12%
   C. WOOD: 15%
   D. GYPSUM BOARD: 12%
   E. PLASTER: 12%

7. VERIFY THE SUITABILITY OF ALL SUBSTRATES THAT APPLY FOR THIS PROJECT:

   A. VERIFY THE GYPSUM BOARD FINISHING COMPOUND IS SANDED SMOOTH.

   B. VERIFY THE PLASTER FINISH IS FULLY CURED, INCLUDING PH TESTING TO DETERMINE ALKALINITY IS WITHIN THE LIMITS ESTABLISHED BY THE MANUFACTURER.

   C. VERIFY THE SPRAY-TEXTURED WALLS AND CEILINGS ARE DRY.

   D. CONCRETE FLOORS: REMOVE THE RELEASE AGENTS, THE CURING COMPOUNDS, EFFLORESENCE AND CHALK SUBSTANCES.

   E. MASONRY SURFACES: REMOVE ANY TRACE OF EFFLORESCENCE AND CHALK.

   F. STEEL SUBSTRATES: REMOVE ALL RUST, LOOSE MILL SCALE, AND SHOP PRIMER (PER MPI). CLEAN AND PREPARE THE SURFACE USING THE METHODS AS INDICATED BY THE PAINT MANUFACTURER'S WRITTEN SPECIFICATIONS. COMPLY WITH SSPC-SP 1 FOR SOLVENT CLEANING, AND SSPC-SP 3 FOR POWER TOOL CLEANING.

   G. SHOP-PRIMED STEEL SUBSTRATES: CLEAN ALL FIELD WELD, BOLTED CONNECTIONS AND ABRADED AREAS OF SHOP-APPLIED PAINT. THEN APPLY PAINT TO THE EXPOSED AREAS WITH THE SAME MATERIAL AS USED FOR THE SHOP PRIMING PER SSPC-PA 1 FOR TOUCH UP TO SHOP-PRIMED SURFACES.

   H. GALVANIZED METAL SUBSTRATES: REMOVE GREASE AND OIL RESIDUE TO ACHIEVE A CLEAN, LIGHTLY ETCHED SURFACE IN ORDER TO ENSURE ADHESION OF THE PAINT SYSTEM.

   I. ALUMINUM SUBSTRATES: REMOVE ALL SURFACE OXIDATION.

   J. WOOD SUBSTRATES:

      1) SCRAPE AND CLEAN ALL KNOTS
      2) APPLY ONE (1) COAT OF A KNOT SEALER PRIOR TO APPLYING A WOOD PRIMER
      3) SAND WOOD SURFACES EXPOSED TO VIEW AND REMOVE ALL DUST
      4) PRIME EDGE, END, UNDERSIDE, BACKSIDE, AND FACE SURFACES OF THE WOOD
      5) FILL ALL HOLES AND FINISH SURFACE IMPERFECTIONS WITH WOOD PUTTY OR WOOD FILLER.

K. GENERALLY CLEAN ALL SUBSTRATES OF SUBSTANCES THAT MIGHT IMPAIR THE BONDING OF PAINTS, LICLUDING BUT NOT LIMITED TO DUST, DIRT, GRIME, OIL, GREASE, ANY INCOMPATIBLE PAINTS AND ENCAPSULANTS, AND INCOMPATIBLE PRIMERS. REPRIME SUBSTRATES AS NECESSARY WITH COMPATIBLE PRIMERS. TIE COATS MAY BE APPLIED TO PRODUCE THE PAINT SYSTEMS REQUIRED.

8. REMOVE ALL HARDWARE, COVERS, COVER PLATES AND SIMILAR ITEMS ALREADY IN PLACE THAT ARE REMOVEABLE AND ARE NOT TO BE PAINTED. IF REMOVAL IS IMPRACTICAL OR IMPOSSIBLE DUE TO THE SIZE AND/OR THE WEIGHT OF THE ITEM, PROVIDE SURFACE-APPLIED PROTECTION PRIOR TO SURFACE PREPARATION AND PAINTING..

9. STEEL ACCESSORIES SHALL RECEIVE TWO (2) COATS ENAMEL PAINT OVER TWO (2) COATS FINELY SANDED PRIMER.

CLEANING AND PROTECTION:

1. UPON COMPLETION OF THE PAINT APPLICATION CLEAN ALL SPATTERED SURFACES. REMOVE SPATTERED PAINTS BY MEANS OF WASHING, GENTLE SCRAPING, OR OTHER METHODS THAT WILL NOT MAR, SCRATCH OR DAMAGE ANY ADJACENT SURFACE. DO NOT MAR, SCRATCH OR DAMAGE ANY ADJACENT FINISH SURFACES.

2. AT THE END OF EACH WORK DAY, REMOVE RUBBISH, EMPTY CANS, RAGS, AND OTHER DISCARDED MATERIALS FROM THE PROJECT SITE. DISPOSAL OF DISCARDED MATERIALS SHALL BE ACCOMPLISHED IN A LAWFUL MANNER.

3. WORK FROM OTHER TRADES SHALL BE PROTECTED AGAINST DAMAGE FROM PAINT APPLICATION. ANY DAMAGE TO THE WORK OF OTHER TRADES SHALL BE PROTECTED BY MEANS OF CLEANING, REPAIRING, REPLACING AND REFINISHING AS APPROVED BY THE ARCHITECT. ALL WORK OF OTHER TRADES SHALL BE LEFT IN AN UNDAMAGED CONDITION.

4. AT THE COMPLETION OF CONSTRUCTION ACTIVITIES OF THE OTHER TRADES THE FINISH PAINTING PROCESS SHALL INCLUDE ANY TOUCH-UP AND DAMAGE RESTORATION.

INTERIOR PAINTING SCHEDULE:

1. GYPSUM BOARD SUBSTRATE:

   A. PRIMER COAT: DUNN-EDWARDS ULTRA-GRIP UGPR00 ACRYLIC INTERIOR/EXTERIOR MULTI-PURPOSE PRIMER, PER MPI STD #17

   B. INTERMEDIATE COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   C. TOP COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   D. COLOR: DUNN-EDWARDS DE 6365 “COLD MORNING”

2. WOOD SUBSTRATE (INCL. TRIM & JAMB FRAMES):

   A. PRIMER COAT: DUNN-EDWARDS ULTRA-GRIP UGPR00 ACRYLIC INTERIOR/EXTERIOR MULTI-PURPOSE PRIMER, PER MPI STD #17

   B. INTERMEDIATE COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   C. TOP COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   D. COLOR: DUNN-EDWARDS DEC 795 “GRAY PEARL”

3. FERROUS METAL:

   A. PRIMER COAT: DUNN-EDWARDS ULTRA-GRIP UGPR00 ACRYLIC INTERIOR/EXTERIOR MULTI-PURPOSE PRIMER, PER MPI STD #17

   B. INTERMEDIATE COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   C. TOP COAT: DUNN-EDWARDS SPARTAWALL SWLL30 INTERIOR EGGSHELL ACRYLIC PAINT PER MPI STD #52

   D. COLOR: DUNN-EDWARDS DE 6385 “BLACK BEAN”

DIVISION 10: SPECIALTIES

SECTION 10 21 13: TOILET PARTITIONS

GENERAL PROVISIONS

1. FURNISH AND INSTALL TOILET PARTITIONS AS SHOWN ON THE DRAWINGS, INCLUDING ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY FOR THE PROPER INSTALLATION OF THE PARTITIONS, ACCESSORIES AND RELATED HARDWARE.

2. SUBMISSIONS: PROVIDE MANUFACTURER'S INSTALLATION DRAWINGS TO THE VENTURA COMMUNITY COLLEGE DISTRICT SHOWING THE SIZES AND LOCATIONS OF EACH COMPONENT, OPENING SIZES, AND MOUNTING HEIGHTS. LABEL COMPONENTS TO CORRESPOND TO INSTRUCTIONS FOR EASE OF INSTALLATION.

3. THE CONTRACTOR SHALL DELIVER WALL MOUNTED PLUMBING ACCESS PANELS TO THE PARTITION MANUFACTURER IN ORDER TO MATCH THE ROTARY SWIRL FINISH OF THE PARTITIONS.

MATERIALS:

1. TOILET COMPARTMENT DOORS AND PARTITIONS SHALL BE 1-INCH THICKNESS OF 22 GAUGE STAINLESS STEEL, AND SHALL BE EITHER WALL OR PILASTER MOUNTED AT HEIGHT AS SHOWN ON THE DRAWINGS WITH MANUFACTURER'S CONCEALED HINGES, THE DOORS SHALL BE EQUIPPED WITH A CONCEALED A.D.A. APPROVED SLIDE LATCH WITH AN EXTERNAL "IN-USE" INDICATOR, ONE (1) ALUMINUM COAT HOOK WITH A RUBBER BUMPER AT 48-INCH HEIGHT.

2. HINGES AND DOOR STRIKES SHALL BE FASTENED BY MEANS OF TAMPER-PROOF TORX-PIN HEAD THROUGH BOLTS WITH A POLISHED CHROME PLATE FINISH.

3. PILASTERS SHALL BE 1¼"-INCH THICKNESS OF 20-GUAGE STAINLESS STEEL FORMED AND FACTORY ASSEMBLED WITH A HONEYCOMB CORE. THE PLINTH AT THE FLOOR MOUNT SHALL BE 3-INCHES HEIGHT, #4 FINISH STAINLESS STEEL AND HAVE STRAIGHT, FLAT SIDES WITH ROUNDED EDGES TO MATCH THE PILASTER PROFILE. SUPPLY LEVELING BOLTS TO THE PILASTER SUPPORT BRACKET.

4. THE PARTITION ASSEMBLY SHALL BE FLOOR PILASTER MOUNTED WITH OVERHEAD SUPPORTS AND BRACED WITH A STRUCTURAL MEMBER SUPPLIED BY THE MANUFACTURER THAT IS FINISHED TO MATCH THE PARTITION AND DOOR FINISH, AND WALL SUPPORTED WHERE SHOWN ON DRAWINGS.

5. THE FINISH SURFACE OF THE PARTITIONS, DOORS, PILASTERS AND OVERHEAD BRACE SUPPORT SHALL BE ROTARY BRUSHED SWIRL. SUBMIT A SAMPLE FOR APPROVAL.

6. PRODUCT: METPAR CORP. THE CORINTHIAN, #FP-500SS STAINLESS STEEL #301/#304 SERIES WITH A #4 SATIN FINISH. METPAR CORP., 95 STATE STREET, P.O. BOX 1873, WESTBURY, NEW YORK, 11590 (516) 333.2600 www.Metpar.com , OR EQUAL

7. NOTE THE PLUMBING WALL ACCESS DOORS SHALL BE SHIPPED TO THE MAUNFACTURER IN ORDER TO APPLY A ROTARY BRUSHED FINISH.

INSTALLATION:

1. THE PARTITIONS SHALL BE INSTALLED PER THE MANUFACTURER'S SPECIFICATIONS, AND AS SHOWN ON THE DRAWINGS.

2. NOTE THE OPENING DOOR WIDTHS: 3'-0" FOR WHEEL CHAIR ACCESSIBLE COMPARTMENTS, 2'-8" FOR ADAPTABLE COMPARTMENTS, 2'-4" FOR OTHER COMPARTMENTS.

3. INSTALL THE PRIVACY PARTITIONS AT THE URINAL LOCATIONS WITH TWO (2) MOUNTING CLIPS EACH AS SHOWN.

4. ALL ROUGH EDGES AND BURRS SHALL BE MADE SMOOTH.

5. PROVIDE LOCKS ON ALL COMPARTMENT DOORS THAT INDICATE "OPEN" OR "OCCUPIED".

6. THE LOCKS ON THE WHEEL CHAIR ACCESSIBLE COMPARTMENTS SHALL COMPLY FULLY WITH ALL DISABILITY ACCESSIBLE REQUIREMENTS.

7. NOTE THE OUT-SWINGING DOORS ON THE DRAWINGS.

DIVISION 10: SPECIALTIES

SECTION 10 28 13: RESTROOM ACCESSORIES

GENERAL PROVISIONS

1. FURNISH AND INSTALL RESTROOM ACCESSORIES AS SHOWN ON THE DRAWINGS, INCLUDING ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY FOR THE PROPER INSTALLATION OF THE PARTITIONS, ACCESSORIES AND RELATED HARDWARE.

2. SUBMISSIONS: PROVIDE MANUFACTURER'S INSTALLATION DRAWINGS TO THE VENTURA COUNTY COMMUNITY COLLEGE DISTRICT SHOWING THE SIZES AND LOCATIONS OF EACH COMPONENT, OPENING SIZES, AND MOUNTING HEIGHTS. LABEL COMPONENTS TO CORRESPOND TO INSTRUCTIONS FOR EASE OF INSTALLATION.

SUBMITTALS

1. SUBMIT MANUFACTURER'S PRODUCT DATA SHEETS INCLUDING THE FOLLOWING:
   A. INSTALLATION INSTRUCTIONS, MOUNTING HEIGHTS AND CLEARANCES
   B. STORAGE AND HANDLING
   C. CLEANING AND MAINTENANCE
   D. REPLACEMENT PARTS INFORMATION
   E. USGBC RECYCLED CONTENT MATERIALS AND CREDITS

MATERIALS:

1. BOBRICK B-2888 TOILET TISSUE DISPENSER AT MEN'S AND WOMEN'S WHEEL CHAIR ACCESSIBLE TOILET COMPARTMENTS

2. BOBRICK B-270 SANITARY NAPKIN DISPOSALS AT WOMEN'S TOILET COMPARTMENTS

3. GEORGIA-PACIFIC #56508 "SOFPULL" TOILET TISSUE DISPENSER SURFACE MOUNT SHALL BE SUPPLIED BY VENTURA COLLEGE AND INSTALLED BY THE CONTRACTOR

4. GEORGIA PACIFIC #57710 "SAF-T-GARD" TOILET SEAT COVER DISPENSER SURFACE MOUNT SHALL BE SUPPLIED BY VENTURA COLLEGE AND INSTALLED BY THE CONTRACTOR

5. WAXIE #850593 "CLEAN & SOFT" PAPER TOWEL DISPENSER SHALL BE SUPPLIED BY VENTURA COLLEGE AND INSTALLED BY THE CONTRACTOR.

6. ACCESSORIES WHERE SHOWN: BOBRICK WASHROOM EQUIPMENT, INC., 11611 HART ST., NORTH HOLLYWOOD, CA 91605-5882; (818) 764.1000. www.bobrick.com

7. SCAFCO PONYWALL 12 GAUGE STEEL SUPPORTS (48-INCH HEIGHT) FACTORY WELDED TO A 3/16" BASE PLATE SHALL BE INSTALLED WITHIN THE WALL CAVITY BETWEEN EACH LAVATORY WITH (6)-5/8" x 3" CONCRETE ANCHORS

INSTALLATION

1. THE INSTALLATION SHALL COMPLY WITH THE REQUIREMENTS OF A.D.A. AND C.B.C., CHAPTER 11B, REFER TO DRAWINGS A-005 AND A-006.

2. INSTALLATION SHALL COMPLY WITH THE MANUFACTURER'S INSTRUCTIONS AND SHALL BE INSTALLED RIGID, STRAIGHT, PLUMB AND LEVEL

3. VERIFY THE BLOCKING HAS BEEN INSTALLED PROPERLY AND COMPLY WITH THE RECOMMENDATIONS FOR BACKING AND SUPPORT

4. VERIFY THE LOCATION DOES NOT INTERFERE WITH DOOR SWINGS OR USE OF FIXTURES

5. USE FASTENERS AND ANCHORS THAT ARE SUITABLE FOR SUBSTRATE AND PROJECT CONDITIONS

6. CONCEAL EVIDENCE OF ANY DRILLING, CUTTING AND FITTING TO THE ADJACENT FINISH SURFACES

7. REPAIR AND PATCH ALL ADJACENT SURFACES FOR A VISIBILY SEAMLESS AND SMOOTH BLENDED FINISH

SECTION 16 000 - GENERAL PROVISIONS

PART 1 - GENERAL

A. The general contract provisions of Section 1000 apply to this section and take precedent over this section in case of conflict.

1.1 GENERAL PROVISIONS

A. This division supplements the applicable requirements of other divisions.

1.2 DEFINITIONS

A. For the purposes of Division 16000, the following definitions apply:

1. Provide: Furnish and install.
2. Indicated: As shown on the drawings or specified herein.
3. Circuit Designation: Panel designation and circuit number, i.e., LA-13.
4. Approved equal: Approved by the engineer of record as equal in his sole determination.

1.3 SCOPE OF WORK

A. The Specifications for Work of Division 16000 include, but are not limited to the following sections:

16000–General Provisions
16030–Tests and Identification
16050–Basic Electrical Materials and Methods
16060–Minor Electrical Demolition for Remodeling
16111–Conduits
16115–Wireways
16116–Wire Basket Cable Trays
16120–Conductors
16130–Electrical Boxes
16133–Terminal Cabinets
16140–Wiring Devices
16142–Nameplates and Warning Signs
16163–Distribution Panelboards
16164–Branch Circuit Panelboards
16170–Disconnects
16190–Support Devices
16270–Pad-Mounted Transformers Liquid-Filled
16450–Grounding
16510–Lighting Fixtures
16721–Fire Alarm and Detection System
16745–Networking & Data Communications

16750–Cabling and Distribution System
16901–General Control Devices
16920–Motor Control

B. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this division, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all divisions for related work required to be included as work under this division.
2. General provisions for electrical work.
3. Site observation including existing conditions.

C. Related Work Specified Elsewhere but included in the scope of work:

1. Motors and their installation.
2. Control wiring and conduit for heating, ventilating and air conditioning.

D. Work Not In Contract (N.I.C.):

1. Telephone instruments.

E. Coordination

1. The following supplements are additional General Requirements pertaining to work of this Division. Provisions of Division 1 - General Requirements shall remain in effect.

a. Coordinate work of various sections of Division 16 and 17.
b. Coordinate work of this Division 16 with work of Divisions 2 through 15.

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. Association of Edison Illuminating Companies (AEIC).

C. Electrical Testing Laboratories (ETL).

D. Illuminating Engineering Society (IES).

E. Institute of Electrical and Electronic Engineers (IEEE).

F. Insulated Cable Engineers Association (ICEA).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories, Inc. (UL).

J. California State Fire Marshal (CSFM).

K. California Energy Commission (CEC) Title 24.

1.5 QUALITY ASSURANCE

A. Regulations: All the electrical equipment and materials, including their installations, shall conform to the following applicable latest codes and standards:

1. California Electric Code, Latest Adopted Edition (NEC), 2016 unless a more current version has been adopted.
2. Local and State Fire Marshal.
3. Occupational Safety and Health Act (OSHA).
4. Requirements of the Serving Utility Company.
5. Local Codes and Ordinances.
6. Requirements of the Office of the California State Architect (OSA).
7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.
8. California Administrative Code, Title 24.
9. County of Los Angeles Codes and Regulations.

B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply. In instances where plans and specifications are at variance or conflict the most restrictive requirement shall apply. Contractor shall be responsible for all his associated work and materials and also the work and materials of related or affected trades.

C. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.

D. Testing and Adjustment:

1. Perform all necessary tests required to ascertain that the electrical system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, that all motors are rotating in the proper directions, and such other tests and adjustments as may be required for the proper completion and operation of the electrical system. Contractor shall provide a copy of all test reports to prove these tests have been performed.

2. If, during the course of testing, it is found that system imbalance is in excess of 20%, rearrange single-pole branch circuit in lighting and receptacle panels to bring system balance to within 20% on all phases. Record all such changes on the typewritten panelboard schedule and submit a summary of changes to the Engineer on the record drawings.

1.6 SUBMITTALS

A. Procedure: In accord with Section General Conditions.

B. Shop drawings: Detailed shop drawings for the following equipment:

1. Branch circuit panelboards.

C. Product data: Detailed manufacturer's data for:

1. Disconnects.
2. Lighting fixtures and associated equipment including control.
3. Gel-filled wire connectors.

D. Test results for the following:

1. Grounding systems.
2. Cables.

E. Include sufficient information to indicate complete compliance with Contract Documents. Include illustrations, catalog cuts, installation instructions, drawings, and certifications. On each sheet show manufacturer's name or trademark.

F. Operating, maintenance, and instruction data for:

G. Instruction materials:

1. Provide at the time of personnel instruction period three bound copies of instruction manuals for the systems as listed in Subparagraph 1.04.A.4.f.

2. Include the following (minimum) information in each copy of instruction manual:

a. Manufacturers' names and addresses including phone numbers.
b. Serial numbers of items furnished.
c. Catalog cuts, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and intended use.
d. Recommended spare parts.

1.7 OWNER'S PERSONNEL INSTRUCTIONS

A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems as listed under operating, maintenance, and instructional data and/or emergency generator, automatic transfer switch and fire alarm annunciator panel.

1.8 CLEANING

A. Clean exterior surfaces and interiors of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.

B. Clean out cracks, corners and surfaces on equipment to be painted. Remove grease and oil spots so that paint may be applied without further preparation.

1.9 PROJECT RECORD DOCUMENTS - Prepare the following and submit to the engineer before final acceptance:

A. Mark Project Record Documents daily to indicate all changes made in the field.

1. In addition to general requirements of Project Record Drawings, indicate on drawings, changes of equipment locations and ratings, trip sizes, and settings on circuit breakers, alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, one-line diagrams, control diagrams and schedules.

B. Use green to indicate deletions and red to indicate additions.

1. Use the same symbols and follow the same drafting procedures used on the Contract Drawings.

C. Locate dimensionally off of contract drawings all underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.

D. At the completion of underground conduit installation provide underground conduit record documents to owner's representative.

E. Two copies, in binder form, of all test results as required by these specifications - 16030.

F. Two copies of local and/or state code enforcing authorities final inspection certificates.

G. Two copies, in binder form, of electrical equipment cut sheets, manufacturer's installation instructions, warranty certificates, and product literature for all products utilized on project.

1.10 SERVICE INTERRUPTIONS AND UTILITY

A. Coordinate with the Owner the interruption of services necessary to accomplish the work.

B. Coordinate with the utility company all work associated with power and communications distribution systems and service entrance equipment.

C. Electrical contractor shall supply temporary power for all trades.

1.11 MINIMUM SPECIFICATION REQUIREMENTS (ALL WORK OF DIVISION 16000)

A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.

1.12 PENETRATION SEALING

A. Seal penetration through exterior walls and fire rated walls, floors, ceilings, and roofs with 3M Firestopping materials of fire rating capacity rated per architectural plans and UBC or prevailing building code requirements.

1.13 PLACING EQUIPMENT IN SERVICE

A. Do not energize or place electrical equipment in service until all interested parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the owner, notify the owner in writing when the equipment will be ready for final testing/connection and schedule to the owner's satisfaction of this service connection. Notify the owner two weeks in advance of the date the various items of equipment will be complete.

1.14 OWNER-FURNISHED ITEMS

A. Pick up Owner-furnished items and handle, deliver, install, and make all final connections.

1. Assume responsibility for the items when consigned at the storage facility or in the field in accord with requirements of the Contract Documents.

1.15 ELECTRIC ITEM LOCATION

A. Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with other trades. Notify owner and engineer of any changes of location requirements prior to installation and obtain engineer's written acceptance for all changes/revisions.

1.16 DEMOLITION

A. Scope: Provide and perform demolition, preparatory and miscellaneous work as indicated and specified, complete.

B. Principle Items of Work:

1. Demolition and removal of existing electrical conduit, wiring and equipment required to complete the project.
2. Preparation of the existing building to receive or connect the new work.
3. Miscellaneous demolition, cutting, alteration, and repair work in and around the existing building necessary for the completion of the entire project.
4. Disconnecting and reconnection of electrical equipment as required by the construction modifications.

C. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures, equipment and wiring (branch circuiting and controls). Provide at bid time any exclusions for existing conditions work.

D. Salvage and Disposal: All removed material other than items to be reused shall be returned to the owner or disposed of in accordance with instructions from the owner's representative. Disposal shall be done in accordance with EPA and governing body requirements and regulations. Contractor shall pay all fees and charges for disposal.

1.17 ELECTRICAL WORKMANSHIP REQUIREMENTS

A. It is required that all electrical construction of this Contract be performed by journeyman electricians. All journeyman electricians shall have a minimum of 4 years of apprenticeship training and hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards. This is intended to mean that a person who does not hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards will not be permitted to do electrical work of any kind that involves new construction, nor make repairs, alterations, additions, or changes of any kind to any existing system of electrical wiring, apparatus, equipment, light, heat, or power.

B. Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under direct and constant personal supervision of a journeyman electrician holding a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

1. Each journeyman electrician will be permitted to be responsible for quality of workmanship for a maximum of eight helpers or apprentices during any same time period, provided the nature of work is such that good supervision can be maintained and quality of workmanship achieved is the best, as expected by Owner and as implied by the latest edition of the California Electrical Code (National Electrical Code with State of California amendments).
2. Before each journeyman electrician commences work, deliver to Owner at project site a photocopy of journeyman's valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

C. All electrical systems shall be installed in a neat and workmanlike manner per National Electrical Code requirements and ANSI approved NEIS National Electrical Installation Standards.

1.18 DESIGN CHANGES AFTER AWARD OF BID

A. When a change in the quantity or size of conductors is made, the conduit size will remain in accordance with that indicated in the original contract drawings rather than the drawing symbol conduit table. When code permits, provide conductor insulation 'THWN' where required to maintain conduit fill conformance with the National Electrical Code.

1.19 MATERIAL AND EQUIPMENT SUBSTITUTION

A. Where two or more trade names or manufacturers are mentioned, selection shall be made from the group listed for use in the base bid. The order in which names are listed is not intended to be any indication of preference.

B. Where a single manufacturer, product or trade name is stated, that manufacturer, product or trade name shall be used in the base bid. The use of other manufacturers, products or trade names will be considered by the engineer of record (unless that product is indicated for no

substitution) only if submitted as alternate items at the time of bidding, with evidence of equality and a statement of net price difference as compared to the specified item. After approval by the engineer of record, the architect and owner reserve the right to review such submittals and to determine the acceptability for use.

C. Equipment other than that specified will be accepted only when written approval is given by the engineer of record and architect, in accordance with Division 1.

D. The contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the architect of equipment other than that specified does not relieve this contractor of this responsibility.

1.20 REQUESTS FOR INFORMATION

A. The contractor shall submit all requests for information (RFI's) typewritten on the attached form.

END OF SECTION 16 000

SECTION 16030 - TESTS AND IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Tests and identification.

1.2 SUBMITTALS

A. In accord with Section 16000.

B. All test values.

1.3 DEFINITION

A. Circuit designation: This term is construed to mean panel designation and circuit number; i.e., LA-13.

1.4 TESTS AND ADJUSTMENTS

A. Prior to energizing, test all systems. Test to ensure systems are:

1. Free from short circuits and grounds.
2. Free from mechanical and electrical defects.

B. Circuit breakers (main and feeder circuits that are adjustable only): Testing and adjustments of circuit breakers shall be made by Owner-approved independent testing firm. Testing firm shall meet the criteria for full membership of the International Electrical Testing Association (NETA).

1. Visual and mechanical inspection:

a. Compare nameplate data with Drawings and Specifications.
b. Inspect circuit breaker for correct mounting.
c. Operate circuit breakers to ensure smooth operation.
d. Inspect case for cracks or other defects.
e. Verify tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method in accord with manufacturer's published data.
f. Inspect mechanism contacts and arc chutes in unsealed units.

2. Electrical tests:

a. Perform a contact-resistance test.
b. Perform an insulation-resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.

c. Perform adjustments for final settings in accord with coordination study supplied by Owner.
d. Perform long-time delay time-current characteristic tests by passing 300% rated current through each pole separately with ground fault functions defeated.
e. Determine short-time pickup and delay by primary current injection.
f. Determine ground-fault pickup and time delay by primary current injection. This test shall be done after short time and instantaneous testing are complete.
g. Determine instantaneous pickup current by primary injection using run-up or pulse method.
h. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3. Test values:

a. Record all test values “as-found” and “as-left” conditions and provide certified copies to Owner.
b. Compare microhm or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than 25%. Investigate any value exceeding manufacturer’s recommendations.
c. Insulation resistance shall not be less than 100 megohms.
d. Trip characteristic of breakers shall fall within manufacturer’s published time-current characteristic tolerance band, including adjustment factors. Circuit breakers not within tolerance band shall be tagged defective.

C. Adjust all installation and equipment for their intended use and rating as defined in manufacturer's specifications and test procedures.

1. Contractor recognizes and understands that the show and character lighting, electronic control equipment, special effects, etc., must have a minimum 4-week adjustment period, occurring after installation and verification of said equipment, for each area or facility. Contractor shall provide appropriate personnel (i.e., electricians, carpenters, laborers) as necessary to support Owner during this adjustment period. Adjustment is defined as orientation of adjustable lighting fixtures, installation of color filters to any lighting fixtures requiring same, location adjustment at 6 ft., control system setting including programming of control functions, system debugging (i.e., cross-wiring). Contractor shall assume day and night activities during the adjustment period.

D. Adjust transformer taps under full load operating conditions, to provide nominal operating voltages at the loads.

E. Hi-Pot test procedures:

1. Test 25 pair, 10 pair, or 4 pair, multi-conductor cables installed in conduit, in the following manner and in presence of Owner:

a. Special Owner-furnished equipment: Hi-Pot Cable Tester & Adapters Model 500.
b. Perform visual inspection to verify:

(1) Proper cable identification tags are installed.
(2) Connector is installed properly and screws and clamps properly tightened.
(3) Elco connector is keyed correctly.

c. Continuity and Hi-Pot:

(1) Using the Hi-Pot cable tester and all necessary adapters:

(a) Set tester on 1500 VDC, S.C. (short continuity), 50 pos.
(b) Hook up cable to "Y" adapter if testing a cable in a conduit or tray.
(c) Attach turnaround Elco test plug to opposite end of cable to be tested.
(d) Attach ground lead of tester to center metal hold-down screw of Elco connector.
(e) Push reset button until tester dial points to zero. Release reset button.
(f) Press start button. Tester will step through all pairs and stop at bottom half of dial. This is because when using the turn-around plug, tester is checking 2-pair runs.

d. Error indication:

(1) No-error dial will make 1/2 revolution and stop. Press reset button. Tester will step to top position.
(2) Fault lights "short" or "open" dial will stop at a pin location indicated on face plate of dial. See chart on side of unit to give correct pin assignments. Press start buttons. Tester will step on through. If another "short" or "open" is found, tester will halt again.

e. Fault correction:

(1) When a fault is indicated, remove both connector shells of cable under test and check indicated pins.
(2) Repair fault using procedure steps as specified in Section 16121, paragraph "Repairing damaged pin-wire assembly."

f. Marking of accepted cable:

(1) Record acceptance of all cables on inspection copy of cable schedule provided by Owner's representative, and submit in accord with Section 16010.
(2) Place inspection stamp of Owner or dot sticker with initials on either white cable tag indicating cable assembly, or on connector shell.

F. Ground systems:

1. Visual and mechanical inspection: Verify ground system is in compliance with Drawings and Specifications.
2. Electrical tests:

a. Perform fall-of-potential test or alternative in accord with IEEE 81 on the main ground electrode or system.
b. Perform point-to-point tests to determine resistance between main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points.

3. Test values:

a. Resistance between main ground electrode and ground shall be no greater than 10 ohms. Additional rods shall be installed and bonded to grounding system and driven to a depth of 50 ft. or refusal, whichever comes first.
b. Investigate point-to-point resistance values which exceed 0.5 ohm.
c. Record all test values and provide certified copies to Owner.

G. Cables:

1. Make insulation resistance tests on all power cables, using a self-contained instrument such as the direct-indicating ohmmeter of the generator type, or "megger" such as manufactured by J.G. Biddle Company, or Owner-approved equivalent. Insulation resistance values shall be at least 75% of shop test records.

a. Apply the following test voltages for 1 minute, except where specified otherwise herein, in accord with procedure recommended by manufacturer of test equipment and as specified herein.

Rated Circuit Voltage	Megger Voltage (DC)	Minimum Megger Reading
600 volts	500 volts	600 kilohms
1000 volts	500 volts	1 megohm
15,000 volts	1000 volts	15 megohms

2. Record all test values and provide certified copies to Owner.
3. Replace cables not meeting specified resistance values.

H. Medium-voltage, 15 Kv cables:

1. Visual and mechanical inspection before testing cables:

a. Compare cable data with drawings and specifications.
b. Inspect exposed sections of cables for physical damage.
c. Inspect that shield grounding, cable support, and terminations are disconnected from any apparatus. Cables shall be positioned to minimize surface leakage current and corona.
d. Verify that visible cable bends meet manufacturer's minimum allowable bending radius.
e. Inspect for adequate fireproofing in common cable areas.
f. Visually inspect splice jacket and insulation condition.

2. Electrical tests:

a. Perform a shield-continuity test on each power cable by ohmmeter method.
b. Perform an insulation-resistance test utilizing a megohmmeter with a voltage output of at least 2500 volts. Individually test each conductor with all other conductors and shields grounded. Test duration shall be 1 minute.
c. Perform a DC high-potential test on all cables. Adhere to all precautions and limits as specified in applicable NEMA/ICEA Standard for the specific cable. Perform tests in accord with ANSI/IEEE 400. Test procedure shall be as follows, and the results for

each cable test shall be recorded as specified herein. Test voltage shall be 50 Kv but shall not exceed 80% of cable manufacturer's factory test value or the maximum test voltage of 55 Kv.

(1) Ensure that input voltage to the test set is regulated.
(2) Current-sensing circuits in test equipment shall measure only the leakage current associated with the cable under test and shall not include internal leakage of test equipment.
(3) Record wet- and dry-bulb temperatures or relative humidity and temperature.
(4) Test each section of cable individually.
(5) Individually test each conductor with all other conductors grounded. Ground all shields.
(6) Terminations shall be adequately corona-suppressed by guard ring, field reduction sphere, or other suitable methods as necessary.
(7) Ensure that maximum test voltage does not exceed limits for terminators specified in IEEE 48 or manufacturer's specifications.
(8) Apply a DC high-potential test in at least five equal increments until maximum test voltage is reached. No increment shall exceed voltage rating of cable. Record DC leakage current at each step after a constant stabilization time consistent with system charging current.
(9) Raise conductor to specified maximum test voltage and hold for 15 minutes on shielded cable. Record readings of leakage current at 30 seconds and 1 minute, and at 1 minute intervals thereafter.
(10) Gradually reduce conductor test potential to zero and measure residual voltage at discrete intervals.
(11) Apply ground for a time period of at least 30 minutes and adequate to drain all insulation stored charge.

3. Test values:

a. Shielding shall exhibit continuity. Investigate resistance values in excess of 10 ohms per 1000 ft. of cable.
b. Investigate any failed high-potential test.
c. Record all test values and report of repairs made and provide certified copies to Owner.

I. Miscellaneous tests:

1. Wiring: check all control circuits for continuity and conformance with wiring diagrams furnished by Owner and manufacturers.
2. Polarity tests: Make continuity and polarity tests on all current and potential transformers to determine whether polarity is as indicated on drawings, and the circuit is continuous.
3. Phasing tests: Identify phases of all switchgear and power cables by stenciling switchgear and tagging cables with approved tags, so that phases can be identified for connecting to proper phase sequence.

1.5 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all electrical distribution equipment shown on single-line diagram, and on control panels, dimmer panels, terminal cabinets, and separately mounted circuit breakers, disconnects, and starters.

B. Provide equipment and circuit designation on nameplates with minimum letter and plate sizes as indicated.

C. Provide engraved plastic nameplates with 1/4 in. minimum height letters indicating:

1. Circuit designation at branch overcurrent devices in distribution panelboards, switchboards, and motor control centers.
2. Circuit designation of panel, equipment-controlled or device-controlled on disconnect switches and on circuit breakers, starters, and controls which are individually enclosed.
3. Voltage rating and circuit designation of all outlets larger than 120V, 20A rating and more than 2 poles.
4. Designation of control and terminal cabinets including CUTC, as indicated.
5. Designation of each contactor and relay in control cabinets.
6. Designate area controlled for each dimmer in dimmer cabinet or rack.
7. Circuit designation at all ground fault detectors and ground fault test receptacles.
8. Equipment designation on front of switchboards, distribution panelboards, branch circuit panelboards, and load centers.

D. Secure nameplates with at least two rivets. Cementing and adhesive installation is not acceptable.

E. Provide two copies of a typewritten directory for each branch circuit panelboard, showing each circuit and its use. Attach one copy to panelboard door and deliver the other copy to Owner.

F. Provide caution label on branch circuit panelboards with integral control compartments. Caution label shall be red with white letters reading "CAUTION, EXTERNAL CONTROL VOLTAGE CIRCUIT WITHIN THIS PANEL."

G. Conductor identification:

1. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices, and in pull boxes.
2. Branch circuits: Identify with corresponding circuit designation at overcurrent device and at all splices.
3. Control wires: Identify with indicated number and or letter designation at all terminal points and connections, including manufacturer pre-wired control sections and cabinets.
4. Alarm and detection wires: Identify with indicated wire and mnemonics numbers at all connections, terminal points, and coiled conductors within cabinets for future termination by Owner.
5. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.

END OF SECTION 16 030

SECTION 16 050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION: Division 1 applies to this Section. This Section contains general requirements for the Sections in Division 16.

A. Related Work Not in Division 16: Refer to individual Division 16 Sections.

1.2 QUALITY ASSURANCE:

A. Codes: Entire installation shall comply with requirements of authorities having jurisdiction.

B. Permits: Contractor shall pay for all permits required by work under this Division.

C. Inspections: Contractor shall arrange for all inspections and correct non-complying installations.

1.3 SUBMITTALS: Refer to Division 1 for procedures.

A. Material and Equipment: Prior to start of work, 6 copies of a list of all materials and equipment covered by Division 16 shall be submitted for approval. Contractor shall allow ample time for checking and processing and shall assume responsibility for delays incurred due to rejected items. No installation of material concerned shall be made until such written approval has been obtained. Approval of materials and equipment shall in no way obviate compliance with the Contract Documents. Each item proposed shall be referenced to the applicable Section, Page, and Paragraph of Division 16. For each item proposed, give name of manufacturer, trade name, catalog data, and performance data.

B. Equipment Layout Drawings: Submit "Equipment Layout Drawings" for each equipment room or area containing equipment items furnished under this Division. Layout Drawings shall consist of plan view of room, to scale, showing projected outlines of all equipment, complete with dotted line indication of all required clearances including all those needed for removal or service. Location of all conduit and pull boxes shall be indicated.

C. Service Manuals: Refer to Section 01700. Indexed Service Manuals shall be submitted which shall include test reports, service instructions, and renewal parts lists of all equipment.

1. Submission and Information: Service Manuals shall be submitted for approval at least 30 days before final inspection. The following information together with any pertinent data, shall be included in Service Manual:

a. Renewal part numbers of all replaceable items.
b. Manufacturer's cuts and rating data.
c. Serial numbers of all principal pieces of equipment.
d. Supplier's name, address, and phone number.

e. Final settings for al breakers, relays, and control devices (See Section 16321 or 16322 as applicable).

2. Copies: Four (4) copies of approved Service Manual shall be delivered on or before date required.

D. Record Drawings: Prepare and submit in accordance with requirements of Section 01700. Contractor shall make notations, neat and legible, daily as the work proceeds. Drawings shall be available for inspection at all times and kept at the job site. All buried conduit and/or indicated future connections outside any building shall be located both by depth and by accurate measurement from a permanently established landmark such as a building or structure.

E. Seismic Calculation: Refer to Article 3.01 herein.

F. Spare Parts: Conform to Section 01700. Deliver following spare parts to Owner and obtain receipts. Submit at same time as Operating Instructions:

1. Spare fuses; 1 set for each combination fuse breaker.
2. Spare pilot light lamps of each type used on project, in quantity of 10%, but not less than 2%.
3. Overload heater elements; 2 sets for each size used on project.

G. Special Tools: If any part of the equipment furnished under Division 16 requires a special tool for assembly, adjustment, resetting, or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with the equipment as a standard accessory and delivered to the Owner as specified in Section 01700.

H. Maintenance Paint: One (1) can of touch-up paint shall be delivered to Owner for each different color factory finish which is to be the final finished surfaces of the product.

1.4 DRAWINGS:

A. Diagrammatic Drawings: For purposes of clarity and legibility, drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible, Contractor shall make use of data in all the Contract Documents and verify information at building site.

B. Routing of Conduit and Piping: The drawings indicate required size and termination of conduits and raceways. It is not intent to indicate all necessary offsets and it shall be the responsibility under this Division to install conduit in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without extra cost to the Owner.

C. Coordination with Other Trades: Check with other Divisions of the Specifications so that no interference shall occur and in order that elevations may be established for the work. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Architect.

1.5 DAMAGE AND REPAIRS:

A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding Contractor's warranty or relieving Contractor of his responsibility during warranty period.

B. Responsibility for Damage: Contractor shall be responsible for damage to grounds, buildings, or equipment due to work furnished or installed under this Division 16.

1.6 PROTECTION, CARE, AND CLEANING:

A. Protection: Provide adequate protection for finished parts of materials and equipment against physical damage from any cause during progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.

B. Care: During entire construction, properly cap all lines and equipment to prevent entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.

C. Cleaning: After installation is completed, clean all systems as follows in addition to requirements specified in Section 01700:

1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing all rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.
2. Factory Finished Items: Remove grease and oil on all factory finished items such as cabinets and controllers, and leave surfaces clean and polished.

D. Connection: Prior to energizing, check all electrical connection hardware and torque where necessary.

PART 2 - PRODUCTS

2.1 PRODUCTS: Products and materials shall be as specified in the pertinent Sections of Division 16.

2.2 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in installation of this work shall be of same manufacturer throughout for each class of material or equipment. Materials shall be new and bear UL label, wherever subject to such approval. Comply with ANSI, IEEE and NEMA standards, where applicable.

PART 3 - EXECUTION

3.1 SEISMIC REQUIREMENTS: Electrical equipment for emergency systems shall be braced to withstand the lateral forces that result from earthquakes. Under Work of Division 16, submit

seismic calculations stamped and signed by a registered California structural engineer confirming size, number, and location of required anchoring hardware. Electrical equipment vendors shall furnish weights together with dimensions and the center of gravity location for all emergency electrical equipment for this purpose.

3.2 GENERAL LATERAL BRACING REQUIREMENTS: As shown on Drawings. Additional bracing requirements shall conform to specific requirements shown on Drawings or in other Sections of Division 16. Anchorages for equipment subject to thermal expansion and movement shall conform to manufacturer's recommendation and intent of general bracing requirements. When general and specific bracing requirements enumerated above are in conflict with referenced standards, the most stringent requirements shall govern.

3.3 EXCAVATION AND BACKFILL: Perform all excavation and back fill required to install Work of Division 16, both inside and outside. Perform all excavation and backfilling in accordance with Division 2.

A. Excavation: Bury conduits outside building to a depth of not less than 24" (or as required by Code) below finish grade, unless noted otherwise.

B. Backfilling: Do not backfill until after final inspection and approval of conduit installation by all legally constituted authorities and recording of the buried items on the Record Drawings.

3.4 CUTTING AND PATCHING:

A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. The Contractor shall submit Drawings showing dimensioned sizes and locations for all such holes to Architect for approval before cutting. Where required for conduit installation, slabs on grade shall be saw-cut to minimum required width; submit cutting Drawings to the Architect for approval before cutting.

B. Patching: Holes or chases shall be patched to match adjacent surfaces.

3.5 CONCRETE WORK: Concrete construction required for the Work of Division 16 shall be provided under the Work of Division 16.

3.6 PAINTING: Finish painting of electrical equipment will be as specified in Division 9, unless equipment is herein specified to be furnished with factory applied finish coats. Equipment to be field painted shall be furnished with a factory applied prime coat.

A. Touch-Up: If factory finish on any equipment furnished under Division 16 is damaged in shipment or during construction of building, the equipment shall be refinished by Contractor to satisfaction of Architect.

B. Concealed Equipment: Uncoated cast-iron or steel that will be concealed, or will not be accessible when installations are completed, shall be given one heavy coat of black asphaltum before installation.

3.7 OPERATING INSTRUCTIONS: Contractor to provide services of an experienced Engineer to instruct Owner in operation of entire installation. Instructional period shall be during normal work day hours. This instruction period may be simultaneous with compliance tests.

3.8 COMPLIANCE TESTS: Conduct such tests of all portions of installation as may be necessary to ensure full compliance with the Drawings and Specifications. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete all the tests. Tests may be required on any item between installation of Work and the end of 1 year warranty period. Should these tests develop any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.

A. All Feeders: Measure and record as follows:

1. 600 volt conductors shall be tested with 500 volt megger to ground on each phase. megger to be on test for one minute before any readings are taken. The minimum values on all feeders shall be 100,000 OHMS.
2. Copies of the certified test readings shall be transmitted to Owner.

3.9 SYSTEM ACCEPTANCE:

A. Final Review: The Contractor shall request a final review prior to system acceptance after:

1. Completion of installation of all systems required under the Contract Documents.
2. Submission and acceptance of operating and maintenance data.
3. Completion of identification program.

B. Acceptance: Is contingent on:

1. Completion of final review and correction of all deficiencies.
2. Satisfactory completion of acceptance tests demonstrating compliance with all performance and technical requirements of Contract Documents.
3. Satisfactory completion of training program and submission of manuals and Drawings required by Contract Documents.

3.10 PRELIMINARY OPERATION: The Owner reserves the right to operate portions of the electrical system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.

3.11 CLEAN-UP: Conform to Section 01700. Upon completion and at other times during progress or Work, when required, remove all surplus materials, rubbish, and debris resulting from Work of Division 16.

END OF SECTION 16 050

SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect and make safe all electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company and Owner=s representative.

C. Provide temporary wiring and connections to maintain required existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area when outage affects business operation.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Security System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Obtain permission from the Owner and security company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply and re-label devices as spares.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Disconnect and remove abandoned conduit.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, and in compliance with new project specifications.

M. Modify existing as-built drawings to note changes.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

3.5 INSTALLATION

A. Install relocated materials and as required by this section and Owner=s representative.

END OF SECTION 16 060

SECTION 16 111 - CONDUITS

PART 1 - GENERAL

A. The general provisions of Section 1000 apply to this section.

1.1 WORK INCLUDED

A. Conduits; including:

1. Rigid steel conduit.
2. Intermediate metal conduit (IMC).
3. Electrical metallic tubing (EMT).
4. Rigid aluminum conduit.
5. Polyvinyl chloride conduit (PVC).
6. Flexible metal conduit.
7. Liquid-tight flexible metal conduit.

1.2 DEFINITION

A. Conduit: This term shall be construed to mean conduit and conduit fittings; and tubing and tubing fittings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Support material: Section 16190.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION - ALL MATERIALS SHALL BE MANUFACTURED IN THE USA.

A. Rigid Steel Conduit: Hot-dipped galvanized or sherardized including the threads, manufactured in accordance with ANSI C80.1 and UL6.

1. Threaded, hot-dipped galvanized or sherardized fittings manufactured in accordance with ANSI C80.4.

B. Intermediate Metal Conduit: Hot-dipped galvanized including the threads, manufactured in accordance with UL 1242.

C. Electrical Metallic Tubing: Manufactured in accordance with ANSI C80.3 and UL 797.

1. Provide compression fittings in walls, ceiling spaces or exposed construction areas.
2. Provide compression (water tight) fittings in damp areas or areas exposed to weather.

D. Rigid Aluminum Conduit: Manufactured in accordance with ANSI C80.5.

1. Threaded fittings, manufactured in accordance with ANSI C80.4.

E. Polyvinyl Chloride Conduit: Schedule 40 and schedule 80, manufactured in accordance with ANSI C33.91, UL 651, and Nema TC-2.

1. Cemented type fittings of the same manufacturer as the conduit.

F. Polyvinyl Chloride Conduit: Type EB, heavy wall, manufactured in accordance with ANSI C33.91, UL651, and Nema TC-8.

1. Cemented fittings of the same manufacturer as the conduit.

G. Flexible Metal Conduit: Hot-dipped galvanized steel, manufacturer in accordance with UL 1.

1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes and twist-in connectors for 1/2-inch and 3/4-inch flexible metal conduit.

H. Liquid-Tight Flexible Conduit: Hot-dipped galvanized with liquid-tight vinyl jacket.

1. Liquid-tight fittings.

PART 3 - EXECUTION

3.1 USE

A. EMT for all exposed and concealed work except as indicated in Paragraphs B, C, D, E, F, and G.

B. Rigid steel, IMC, or rigid aluminum conduit in areas where exposed conduit could be subject to physical damage or where conduit is exposed and conductor phase to ground voltage exceeds 300 volts.

C. Rigid aluminum conduit may be used for all feeder runs exposed or concealed in stud walls and spaces above suspended ceilings.

D. PVC Conduit:

1. Schedule 40 for runs below grade in direct contact with earth.
2. Schedule 40 in concrete floors, walls or roofs.

E. Flexible Conduit (steel only permitted):

1. For connection to equipment subject to vibration, maximum length 18 inches. In wet locations use liquid-tight flexible conduit.
2. For connection to lighting fixtures above suspended ceilings. Lengths limited to 72 inches.
3. Install ground conductors in all flexible conduits.

F. Where 3/4-inch conduit runs are concealed in walls or ceilings and these runs are through wood studs and wood joists, flexible steel conduit may be used up to a maximum length of 6'0".

G. All risers shall be PVC coated RGS with bushings.

H. In concrete or below grade use conduit not smaller than 1 inch. Maximum size in concrete slab: 1 inch. Run larger sizes under slab.

I. Use long sweep elbows with minimum radius 10 times nominal conduit diameter for all telephone and communication runs.

3.2 INSTALLATION

A. Provide conduit support and bracing in accordance with the latest published SMACNA guidelines.

B. Perform excavating, trenching, backfilling, and compacting as specified in Division 2.

C. Minimum cover for runs below finished grade outside buildings: 24 inches except where noted or required by the serving utility. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab. Minimum cover under building slabs is 12-inches.

D. Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches. Avoid running conduit directly under water lines.

E. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.

F. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.

G. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings.

H. Run a minimum of one 3/4-inch empty conduit for every three single pole spare circuit breakers, spaces or fraction thereof and not less than two 3/4-inch conduits from every flush mounted panel to an accessible space above the ceiling and below the floor.

I. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.

J. Where conduit is to remain empty, install polypropylene or nylon pull-line 3/16" minimum diameter from end to end with tag at each end designating opposite terminations.

K. Run conduit parallel and at right angle to building lines, when visible in finished construction.

L. Cap conduits indicated to be stubbed-out underground using glued-on PVC caps intended for this purpose.

M. Install a coupling flush with the floor on all conduits stubbed up through floors on grade.

N. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.

O. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps.

P. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.

1. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.
2. Use blockouts for concentrations of conduits in a confined area.

Q. Do not penetrate walls with flexible conduit where subject to physical damage. Use recessed box with extension ring for transition from interior to exterior of wall.

R. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 360 degrees between them unless otherwise indicated.

S. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.

T. Provide bushings on all conduit terminations sized 1" and larger.

U. Provide weatherproof boxes and connectors for all exposed parking structure raceways and boxes.

V. Provide bell ends on all conduits into pullboxes and manholes, seal all conduits after conductors are pulled.

W. Cap all unused conduits with end cap. Do not tape.

END OF SECTION 16 111

SECTION 16115 - WIREWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Wireways, sheet metal troughs with screw-on removable covers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hoffman Engineering Co.

B. General Electric Co.

C. Square D Co.

2.2 MATERIAL AND FABRICATION

A. Use sheet steel wireways with screw-on covers and corrosion resistant hardware. For dry locations coat with rust inhibitor and finish with gray baked enamel. For wet locations use hot-dipped galvanized material finished with gray baked enamel, provide gaskets for covers as required. Provide (permanent engraved (3/4” letters) labels on all covers to signify voltage, communications or telephone.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wireways shall be securely fastened to the mounting surface. Use expansion type anchors in concrete. Suspended wireways shall be supported 4 feet on centers.

END OF SECTION 16 115

SECTION 16116 - WIRE BASKET CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire basket support systems as shown on the drawings.

B. Wire basket support systems are defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

D. ASTM A123 - Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

E. ASTM A510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

F. NEMA VE 2-2000 - Cable Tray Installation Guidelines

1.3 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the wire basket support systems. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.4 SUBMITTALS

A. Submittal Drawings: Submit drawings of wire basket and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps and hold down plates showing accurately scaled components.

B. Product Data: Submit manufacturer's data on wire basket support system including, but not limited to, types, materials, finishes and inside depths.

1.5 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

B. NFPA Compliance Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver wire basket support systems and components carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.

B. Store wire basket and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, wire basket support systems to be installed shall be as manufactured by Cooper B-Line, Inc. or engineer-approved equal.

2.2 WIRE BASKET SECTIONS AND COMPONENTS

A. General: Provide wire basket of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Materials and Finishes: Material and finish specifications for each wire basket type are as follows:

1. Yellow Zinc Dichromate: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated yellow zinc dichromate in accordance with ASTM B633 SC2.

2. Hot-Dip Galvanized After Fabrication: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be coated after the wire basket runway has been fabricated in accordance with ASTM A123 (CSA Type 1). All hot-dip galvanized after fabrication runway sections must be returned to the point of

manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so may result in damage to cables and/or injury to installers.

3. Stainless Steel: Straight sections and accessories shall be made from AISI Type 304 Stainless Steel.

4. Paint: Straight sections shall be painted [Computer White][Flat Black][Telco Gray] over Yellow Zinc Dichromate.

5. Pre-Galvanized Zinc: Wall brackets and other pre-galvanized accessories shall be coated with zinc in accordance with ASTM A653.

6. Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.

2.3 TYPE OF WIRE BASKET SUPPORT SYSTEM

A. All straight section longitudinal wires shall be straight (with no bends).

B. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

C. Wire basket sizes shall conform to the following nominal criteria:

1. Straight sections shall be furnished in standard 118 inch lengths.
2. Wire basket shall have a 4 inch usable loading depth by 12 inches wide.

D. All fittings shall be field formed as needed.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.

F. Wire basket supports shall be trapeze hangers or wall brackets as manufactured by Cooper B-Line, Inc. or engineer approved equal.

G. Trapeze hangers or center support hangers shall be supported by 1/4 inch or 3/8 inch diameter rods.

H. Special accessories shall be furnished as required to protect, support and install a wire basket support system.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install wire basket as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate wire basket with other trades as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing wire basket to permit access for installing and maintaining cables.

3.2 TESTING

A. Test wire basket support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1.

END OF SECTION 16 116

SECTION 16 120 - CONDUCTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Conductors; for power, lighting, sound, communication and control, including conductors for general wiring, flexible cords and cables, and ground conductors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 16000.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Conductors for General Wiring: Thermoplastic insulated rated for 600V manufactured in accordance with UL 83.

1. Provide 3/4 hard drawn copper conductors. Provide solid conductor for #12 AWG and smaller. Provide stranded conductors for #10 AWG and larger.

B. Conductor Connectors for General Wiring:

1. Sizes No. 14 to No. 8: Splice with insulated spring wire connectors.

a. Ideal No. 451, 455 and 453.
b. Minnesota Mining: Types Y, R, G, and B.
c. Buchanan No. B1, B2 and B4.

2. Size No. 6 or Larger, Copper: Splice and terminate with compression or pressure type connectors and terminal lugs.

C. Provide connector sealing packs for all area lighting and exterior box splices which require complete protection from dampness and water.

1. Scotchlok No.’s 3576, 3577 and 3578, by 3M Company.

PART 3 - EXECUTION

3.1 USE

A. Conductors for General Wiring:

1. Minimum 75 degrees C temperature rated insulation on conductors, except use minimum 90 degrees C temperature rated insulation on conductors in conduits exposed on roof, or where required due to ambient temperature.
2. Stranded conductors at motors and other applications where subject to vibration.
3. Minimum size conductors for power and lighting #12 AWG, except where noted.
4. Minimum size conductors for control circuits #14 AWG stranded with THHN/THWN insulation.

B. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.

C. Ground Conductors:

1. Provide an insulated green ground conductor for all branch circuit wiring where indicated.
2. Bare copper conductor may be used.

a. Install ground conductors in all non-metallic conduits as required by code. Install ground conductors in all motor branch circuits and all feeders. Where ground conductor size is not indicated, provide size as required for an equipment ground conductor by the National Electrical Code.
b. Install ground conductors in all flexible metal conduits.

3.2 INSPECTION

A. Check conduit system for damage and loose connections, replace damaged sections.

B. Check for caps at conduit openings. Make sure that inside of conduit is free of dirt and moisture.

C. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.

3.3 INSTALLATION

A. Conductors for General Wiring:

1. Color code conductors insulation as follows:

	SYSTEM VOLTAGE	
CONDUCTOR	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

2. For conductors #6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

a. Provide color tape on each end and at all terminal points and splices on wire enclosed in conduit.

b. Provide color tape every 3 feet on wire not enclosed in a listed wireway.

3. When pulling conductors, do not exceed manufacturer's recommended values.
4. Use polypropylene or nylon ropes for pulling conductors.

B. Insulate splices with plastic electrical tape: Scotch No. 33+, Tomic No. 1T, or equal.

C. Terminate all control wires with terminal lugs on terminal boards not designed with pressure plates. If splices are needed, use same procedure, installing a terminal board in a junction box for protection.

D. All splices or connections shall be compression type Thomas & Betts or Burndy, no split bolt connections are allowed.

3.4 IDENTIFICATION

A. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.

B. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.

C. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.

D. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connections, terminal points, and coiled conductors within cabinets.

E. Conductors Terminated By Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.

F. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.

G. Circuit designation is construed to mean panel designation and circuit number, i.e., LA-13.

END OF SECTION 16 120

SECTION 16 130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Boxes; including:

1. Outlet boxes.
2. Pull and junction boxes.
3. Cabinets.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 16000.

B. Support Material: Section 16190.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Outlet Boxes:

1. Pressed Steel Boxes: Knockout type, hot-dipped or electro-plate galvanized.
2. Cast Iron Boxes: Hot-dipped or electro-plate galvanized with threaded hubs.
3. Cast Iron Conduit Bodies: Hot-dipped or electro-plate galvanized with threaded hubs.
4. Cast copper free aluminum conduit bodies with threaded hubs.
5. Covers for Pressed Steel Boxes: Hot dipped or electro-plate galvanized.
6. Outlet boxes manufactured in accordance with UL 514.

B. Pull and Junction Boxes:

1. Sheet steel, hot-dipped or electro-plate galvanized, or prime coated and a final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

    a. Where exposed to weather, provide raintight hubs for conduits entering the boxes, top and sides only.

2. Floor Boxes:

    a. Single gang, similar to Hubbell #B-2536.
    b. Covers:

        1) Combination, similar to Hubbell #S-2525.

2) Duplex receptacle, similar to Hubbell #S-3925.

c. Carpet flange, similar to Hubbell #S-3075 thru #S-3079.
d. Hubs: Provide hubs as required to suit the conduit arrangement.

3. Pre-Cast Concrete Pull Boxes: As manufactured by Jensen Pre-Cast or Utility Vault and shown on drawings.
4. High impact resistant PVC boxes: As manufactured by Carlon, Sedco, or R & G Sloan.

C. Cabinets: Sheet metal, prime coat and final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

1. Control Cabinet: NEMA 1 enclosure, door with butt hinges and flush handle latches.

a. Provide with removable steel back panel.

2. Terminal Cabinets: NEMA 1 enclosure, door with concealed hinges and spring catch type flush cylinder locks. Key locks alike, provide two keys with each lock.
3. Provide engraved plastic nameplates with 1/2" minimum height letters indicating designation of control and terminal cabinets as shown on the drawings.

a. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

PART 3 - EXECUTION

3.1 USE

A. Outlet Boxes:

1. Ceiling Outlet Boxes: Not less than 4" octagonal by 2" deep.
2. FDD cast iron or cast aluminum device boxes and conduit bodies with metal covers for exposed conduit installation. Provide gasket for covers in wet areas.
3. Intercom, Microphone and TV Outlet Boxes: Not less than 4-11/16" square x 2-1/8" deep.
4. Provide floor boxes with quantity of gangs as required for power, communication or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.

B. Pull and Junction Boxes:

1. Use sheet steel boxes NEMA Type 1 for indoor and NEMA Type 3R for outdoor installation, except as follows.
2. Use pre-cast concrete boxes for boxes flush in finish grade where requiring a nominal capacity greater than 144 cubic inches, where located in vehicular traffic areas, or where indicated.
3. Use polyvinyl chloride (PVC) boxes flush in finish grade when the nominal internal volume is less than or equal to 144 cubic inches or where indicated.
4. Use cast iron boxes for boxes flush in slab on grade.

3.2 INSTALLATION

A. Provide 3/8" fixture studs in wall bracket and ceiling boxes.

B. Provide covers suitable for the fixtures or devices used.

C. Make outlet box covers flush with finished surfaces.

D. Close unused open knockouts with knockout seals.

E. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.

F. Where boxes are concealed in exposed concrete unit masonry, use square cornered types or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.

G. Provide a 6" base of compacted crushed rock under pre-cast concrete pull boxes.

H. Adjust floor boxes so they are level with top of finished floors.

I. Provide pull boxes and junction boxes in all branch circuit and feeder runs as indicated. Do not provide pull boxes unless they are indicated or required by the Electrical Code.

3.3 IDENTIFICATION

A. Junction Boxes: Use permanent black marker, 2” high lettering, and on each cover plate indicate the power source and circuits contained within that junction box.

END OF SECTION 16 130

SECTION 16 133 - TERMINAL CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION: Division 1 and Section 16050 apply to this Section. Provide terminal cabinets for signal and communications terminals, complete.

A. Related Work Not In This Section:

1. Outlet, pull, and junction boxes.
2. Panelboards for lighting and power.

PART 2 - PRODUCTS

2.1 MATERIALS: Cold rolled sheet steel, with hinged door and cylinder lock keyed to match panelboard cabinets.

2.2 DESIGN: To suit applicable system requirements; surface or flush-mounting as shown; knockouts as required. Design to match panelboard cabinets.

2.3 FABRICATION: One-piece, die-formed or continuously welded, and assembled in factory.

2.4 FINISH: Baked enamel on a suitable primer; color as specified elsewhere, required by standards, or as directs.

2.5 INTERIORS: Provide 5/8" plywood (fire resistant) backing in all signal and communications terminals.

PART 3 - EXECUTION

3.1 INSTALLATION: Secure and substantial, cabinets attached to building walls or structure.

3.2 IDENTIFICATION: Provide identification nameplates; of engraved bakelite; riveted or screwed to each cabinet. Take text from Drawings and as approved by Architect.

END OF SECTION 16 133

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wiring devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Identification: Section 16030.

B. Boxes: Section 16130.

1.3 SUBMITTALS

A. In accord with Section 16000

1.4 DEFINITION

A. Wiring devices: This term includes all wall switches, pushbuttons, receptacles, and plates used for general purpose installation.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Wall switches:

1. Quiet decora nova series type, 20A – 120/277 VAC rated, with terminal screws to take up to No. 10 AWG conductors:

	SPST	DPST	3-WAY	SPST KEY SWITCH LOCK	4-WAY
Arrow-Hart	1991-I	1992-I	1993-I	1991-L	1994-I
Bryant	4901-I	4902-I	4903-I	4901-L	4904-I
General Electric	GE5951-2	GE5952-2	GE5953-2	GE5951-OL	GE5954-2
Hubbell	1221-I	1222-I	1223-I	1221-L	1224-I
Pass & Seymour/ Legrand	20AC1-I	20AC2-I	20AC3-I	20AC1-L	20AC4-I

2. Momentary contact type, 20A-120/277V, two-circuit, three-position, center off:

Arrow-Hart	1995-I
Bryant	4921-I
General Electric	GE5935-2
Hubbell	1557-I
Pass & Seymour/Legrand	1250-I

3. Passive infrared wall switch sensors: Architect chooses color, 180° field of view, adjustable time out and ambient light, 1200 sq. ft. Coverage, 120 VAC, 60 Hz, 1500W. Maximum load, incandescent and fluorescent. As manufactured by Hubbell No. AT1201 or Owner- approved equivalent by Leviton or Pass & Seymour.
4. Fan speed controllers: AC unit rated 15A - 120V used to control up to twelve 56 in./52 in./48 in. ceiling fans or up to twenty 42 in. fans on a single circuit. Rinaudo's Reproductions No. 22394.

B. Passive infrared motion switching system:

1. Ceiling mount sensor, white, 500 sq. ft. coverage, requires control unit. Hubbell No. ATD500CRP.
2. Ceiling mount sensor, white, 2000 sq. ft. coverage, ceiling height dependent, requires control unit. Hubbell No. ATD2000CRP.
3. Ceiling or wall mount sensor, white, 1000 sq. ft. coverage, requires control unit. Hubbell No. ATD1000CRP.
4. Ceiling or wall mount hallway sensor, white, covers area 75 ft. long by 20 ft. wide, requires control unit. Hubbell No. PIR90HW1.
5. Low-voltage control unit, 120VAC, controls one to four sensors. Mount in 4 in. x 4in. enclosure. Hubbell No. CU120A.
6. Relay, 120VAC coil, used when load to be controlled exceeds capacity of a single circuit. Hubbell No. AAR

C. Receptacles, caps, and connectors:

1. 15A-125V, NEMA 5-15, parallel slot type with grounding pin: decora type - Nova Series

	DUPLEX	SINGLE	GFI
Arrow-Hart	5252-I	5261-I	GF5242-I
Bryant	5252-I	5261-I	GFR52FT
General Electric	5252-2	5261-2	TGTR115F
Hubbell	5252-I	5251-I	GF5252-I
Pass & Seymour/Legrand	5252-I	5261-I	1591-SHG

2. 15A-250V, NEMA 6-15, straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5661-I	6666
Bryant	5661-I	5666-N
General Electric	GE4069-2	GED0611
Hubbell	5661-I	5666-C
Pass & Seymour/Legrand	5662-I	5666-X

3. 15A-125V, NEMA L5-15, locking type with ground: decora type Nova Series

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	4700	4721	4731
Bryant	4700	4721-NSY	4732-NSY
General Electric	GL4700	GLD0511	GLD0513
Hubbell	4700	4720-C	4729-C
Pass & Seymour/Legrand	4700	L515-P	L515-C

4. 20A-125V, NEMA 5-20, straight blade grounding type: decora type Nova Series

	RECEPTACLE	CAP
Arrow-Hart	5361-I	5362-I
Bryant	5361-I	5362-I
General Electric	GE4102-2	GE4108-2
Hubbell	5361-I	5362-I
Pass & Seymour/Legrand	5361-I	5362-I

5. 20A-125V, NEMA L5-20, two-pole, three-wire locking type, with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6200	6202	6204
Bryant	70520-FR	70520-NP	70520-NC
General Electric	GL0520	GLD0521	GLD0523
Hubbell	2310-A	2311	2313
Pass & Seymour/Legrand	L520-R	L520-P	L520-C

6. 20A-125V, NEMA 5-20, two-pole, three-wire, straight blade isolated grounding type receptacle: decora type Nova Series

	DUPLEX	SINGLE
Arrow-Hart	IG5362	IG5361
Bryant	5362-IG	5361-IG
General Electric	GE8300-IG	GE8310-IG
Hubbell	IG-5362	IG-5361
Pass & Seymour/Legrand	IG-6300	IG-5361

7. 20A-125 VAC, two-pole, three-wire, NEMA 5-20, decora type Nova Series straight blade, specification grade, color by architect, ground fault circuit interrupter receptacle (GFCI), rated for feed-through wiring, with LED indicator light:

	GFCI RECEPTACLE
Hubbell	GF-5362I
Pass & Seymour	2091-S-L-I
Leviton	6898-I

8. 20A-125/250V, NEMA 14-20, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5759	5757
Bryant	-	-
General Electric	GE1420	GED1421
Hubbell	8410	8411-C
Pass & Seymour/Legrand	L1420-R	L1420-P

9. 20A-250V, NEMA 6-20, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	8510	6866	6869
Bryant	5461	5466N	5469N
General Electric	GE4182	GED0621	GED0623
Hubbell	5461	HBL5466-C	HBL5469-C
Pass & Seymour/Legrand	5871	5466-X	5469-X

10. 20A-120/208V, NEMA L21-20, four-pole, five-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6470	6472	6474
Bryant	72120-FR	72120-NP	72120-NC
General Electric	GL2120	GLD2121	GLD2123
Hubbell	2510A	2511	2513
Pass & Seymour/Legrand	L2120R	L2120P	L2120C

11. 20A-250V, NEMA L6-20, two-pole, three-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6210	6212	6214
Bryant	70620FR	70620NP	70620NC
General Electric	GL0620	GLD0621	GLD0623
Hubbell	2320A	2321	2323
Pass & Seymour/Legrand	L620-R	L620-P	L620-C

12. 20A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6430	6432	6434
Bryant	71620-FR	71620-NP	71620-NC
General Electric	GL1620	GLD1621	GLD1623
Hubbell	2430A	2431	2433
Pass & Seymour/Legrand	L1620-R	L1620-P	L1620-C

13. 30A-125V, NEMA 5-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5716N	5717N	6716N
Bryant	9530-FR	9630-RP	-
General Electric	GE4138-3	GED0531	GED0533
Hubbell	9308	9309	-
Pass & Seymour/Legrand	3802	5921	-

14. 30A-125V, NEMA L5-30, two-pole, three-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6330	6332	6334
Bryant	70530-FR	70530-NP	70530-NC
General Electric	GL0530	GLD0531	GLD0533
Hubbell	2610	2611	2613
Pass & Seymour/Legrand	L530-R	L530-P	L530-C

15. 30A-125/250V, NEMA 14-30, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5744N	5746N
Bryant	9430-FR	5746
General Electric	GE4191-3	GED1431
Hubbell	9430	9431
Pass & Seymour/Legrand	5740	5741-AN

16. 30A-125/250V, NEMA L14-30, three-pole, four-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6510	6512	6514
Bryant	71430-FR	71430-NP	71430-NC
General Electric	GL1430	GLD1431	GLD1433
Hubbell	2710-A	2711	2713
Pass & Seymour/Legrand	L1430-R	L1430-P	L1430-C

17. 30A-250V, NEMA L6-30, two-pole, three-wire locking blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6340	6342	6344
Bryant	70630-FR	70630-NP	70630-NC
General Electric	GL0630	GLD0631	GLD0633
Hubbell	2620-A	2621	2623
Pass & Seymour/Legrand	L630-R	L630-P	L630-C

18. 30A-250V, NEMA 6-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5700N	5701N	6700N
Bryant	9630-FR	9630-ANP	-
General Electric	GE4139-3	GE4328-9	GE4373-9
Hubbell	9330	9331	-
Pass & Seymour/Legrand	3801	5931	-

19. 50A-208V (50A-600V), three-pole, four-wire locking type with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	3769	3765	3764
Bryant	3769	3765	3764
General Electric	LD3769	LD3765	LD3764
Hubbell	3769	3765-C	3764-C
Pass & Seymour/Legrand	3769	3765	3764

20. 50A-125/250V, NEMA 15-50, three-pole, four-wire grounding straight blade type:

	RECEPTACLE	CAP
Arrow-Hart	5754N	5745N
Bryant	9450-FR	5745
General Electric	GE4181-3	GE4180-3
Hubbell	9450	9451
Pass & Seymour/Legrand	5750	5751-AN

21. 50A-125/250V, three-pole, four-wire grounding locking blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	CS6369	CS6365	CS6364
Bryant	CS6369	CS6365	CS6364
General Electric	-	-	-
Hubbell	CS6369	CS6365	CS6364
Pass & Seymour/Legrand	-	-	-

22. 50A-250V, NEMA 6-50, two-pole, three-wire grounding straight blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5709N	5710N	6709N
Bryant	9650-FR	9650-RP	-
General Electric	GE4141-3	GED0651	GED0653
Hubbell	9367	9368	-
Pass & Seymour/Legrand	3804	3869	-

23. 60A-120/208V, three-phase, 60 Hz, five-pole, five-wire, watertight, with threaded cap:

	BOX	ANGLE ADAPTER	RECEPTACLE BODY	COMPLETE ASSEMBLY
Hubbell	26401	26404	26520	-
Crouse-Hinds	-	-	-	Area-6575
Russell Stoll	-	-	-	DS6516-FRAB-

24. 60A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	-	-	-
Bryant	-	-	-
General Electric	-	-	-
Hubbell	HBL 26410	HBL 26402	HBL 26418
Pass & Seymour/Legrand	-	-	-

D. Safety receptacle: 15A-125V, NEMA 5-15, straight blade grounding safety receptacle, decora type Nova Series Hubbell No. SG-62H-1.

E. Door monitoring switches:

1. General: Provide magnetic door switches (one per leaf) and key switches at specific door locations as indicated on Drawings. Refer to Electrical Drawings details for schematic installation details of door switches.
2. Magnetic contact switches: Provide concealed magnetic SPDT switches with minimum 6-ft. wire leads, Sentrol No. 1076W-06 for hollow metal doors and frames. Where necessary, provide other similar Sentrol types to suit concealed installation conditions, as approved by Owner and compatible with Owner's ride control and/or existing security system equipment. Color of switches to closely match finish or paint color of door frame.
3. Key switches: Arrow-Hart No. 1191L.

F. Device cover plates:

1. Interior plates: Specification grade plastic, 0.1 in. thick, color by architect, UL listed.

   a. Plates in kitchens and restrooms to be polished stainless steel, 0.040 in. thick except in kitchens use double lift lid weatherproof gasketed plates for convenience receptacles.
   b. MATV plate: RMS No. CA-4028.

2. Exterior plates: Choose type of exterior cover plate in accord with the device location and/or manner in which device will be used. Device cover plates shall be die-cast aluminum with hinged cover, rated for respective type of use specified below, or as indicated on Drawings.

   a. Outlet box weatherproof hoods: NEMA 3R rating, gasketed, for unattended use with cover closed, padlockable latching cover to meet OSHA lockout/tagout requirements, large cord opening and UL listed. As manufactured by Hubbell, Intermatic or Leviton.
   b. Low profile weatherproof cover: Gasketed, approved for use with cover open, self-closing hinged covers (two independent self-closing lids for duplex receptacles which are horizontally mounted), UL listed. As manufactured by Hubbell, Leviton or Pass & Seymour.
   c. Communication outlet weatherproof hoods: NEMA 3R rating for unattended use with cover closed, two-cord openings and UL listed. As manufactured by Red Dot.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount switches and receptacles in vertical position in building interiors.

B. Mount receptacles with weatherproof plates in horizontal position.

C. Install receptacles mounted vertically so that the ground contact falls on the top position, and horizontally-mounted receptacles with neutral pole in top position.

D. Use plastic blank plates on J-boxes in public areas.

E. Use mechanical type door switches for load control.

F. Install receptacles for plug in lighting fixtures within 36 in. of fixture location.

G. Use safety type receptacles with low profile weatherproof metal covers for all convenience outlets in guest accessible areas (i.e., queue lines, waiting areas, etc.).

H. All GFI type exterior receptacles shall be provided with weatherproof metal hoods.

I. GFI type receptacles shall not be fed-through wire.

END OF SECTION 16 140

SECTION 16142 - NAMEPLATES AND WARNING SIGNS

PART 2 - PRODUCTS

2.1 Nameplate shall be plastic laminate with 3/4" high letters in white on black background screwed onto equipment designations shall clearly state:

A. Equipment Enclosure Nameplates.

1. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.
2. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable. Designation data per drawings or to be supplied with shop drawings approval.

B. Device nameplates: Device usage, purpose, or circuit number; manufacturer and electrical characteristic ratings including the following:

1. Circuit Breakers: Voltage, continuous current, maximum interrupting current and trip current.
2. Switches: Voltage, continuous current, horsepower or maximum current switching. If fused, include nameplate stating "Fuses must be replaced with current limiting type of identical characteristics."
3. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held".
4. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class and temperature.
5. Controllers: Voltage, current, horsepower and trip setting of motor running over current protection.

2.2 Warning signs shall be minimum 18 gauge steel, white porcelain enamel finish with red lettering. Lettering to read "DANGER - HIGH VOLTAGE" in 1" letters. Warning signs to be included on door or immediately above door of all electrical equipment rooms, vaults or closets containing equipment rooms, vaults or closets containing equipment energized above 150 volts to ground, except where such spaces are accessible from public areas.

2.3 Warning designation in 1" red letters shall be painted by stencil or pre-printed adhesive on each pull box, cabinet or 1-foot length of exposed conduit stating "DANGER" and giving voltage of enclosed conductors such as "DANGER - 480 VOLTS", for all systems over 150 volts to ground.

PART 3 - EXECUTION

3.1 Nameplates shall be mounted by self-tapping or threaded screws and bolts or by rivets.

3.2 Signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

END OF SECTION 16 142

SECTION 16 164 - BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Branch circuit panelboards.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 16000.

B. Overcurrent Protective Devices: Section 16180.

C. Control Devices: Section 16901.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide factory assembled, enclosed panelboards in dead front cabinets, with doors, surface mounted or recessed as indicated, not less than 20" wide and 5-3/4" deep. Height will depend on the number of breakers and spaces.

B. Where a control compartment is indicated, provide an integral compartment with a separate hinged lockable door held with captive screws. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.

C. Provide feeder terminal lugs for both main lugs only and main breakers rated for use with copper conductors.

D. Provide full length copper bussing including areas indicated as space only.

E. Provide full size neutral bus where neutral bus is indicated. Provide equipment ground bus and bolt-on circuit breakers.

F. Key all door locks alike.

G. 120/208V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NQOD or Powerlink G3 NF with programmable module where designated, alternate bid for General Electric type AQ.

H. 277/480V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NF, alternate bid for General Electric type CCB.

I. All equipment shall be listed to meet or exceed the available fault current by 10%.

J. Doors shall be hinged.

K. All placards are welded steel type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure panelboards to building structure to withstand wire pulling strains.

B. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

C. Do not use toggle bolts.

D. Contractor shall program lighting control Powerlink panelboard per owner's requirements.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all branch circuit panelboards shown on the single line diagram.

B. Provide panelboard and source feed designation on nameplates with 3/8" minimum height lettering for the panel name and 1/4" height lettering for the source feed designation.

EXAMPLE:	LA
FED FROM:	DLA

C. Secure nameplates with at least two spaces or rivets. Cementing and adhesive installation not acceptable.

D. Provide a typewritten directory for each branch circuit panelboard, showing each circuits and its use. Provide metal directory frame with plastic window.

END OF SECTION 16 164

SECTION 16 170 - DISCONNECTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Disconnects: Switches, fused or unfused.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 16000.

B. Fuses: Section 16180.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D Company

B. General Electric

2.2 MATERIAL AND FABRICATION

A. Provide heavy duty type, quick-make, quick-break disconnects with cover interlocks.

B. Provide NEMA Type 1 enclosure for dry locations, provide the proper enclosure for other locations as indicated.

C. Provide motor rated toggle switches where indicated.

D. Provide fused disconnect for elevator drive motors.

E. Provide rejection clips on disconnects where rejection type fuses are to be installed.

PART 3 - 3.00 - EXECUTION

3.1 INSTALLATION

A. Securely fasten disconnects to structure to withstand wire pulling strains.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on individually mounted disconnects with minimum 1/4" height letters indicating the load served and the source feed designation.

EXAMPLE: LOAD: A/C-1
FED FROM: DHA-1

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION 16 170

SECTION 16 190 - SUPPORT DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Support devices for conduit, boxes, lighting fixtures and equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers, Straps and Beam Clamps:

1. Efcor.
2. Raco, Inc.
3. Steel City.
4. O.Z./Gedney Co.
5. Caddy Fastening System by ERICO Products Inc.

B. Channels and Fittings:

1. Kindorf.
2. Unistrut Corp.

C. Anchors:

1. Acherman-Johnson Corp.
2. Phillips Drill Co.
3. Rawl Products Co.

2.2 MATERIAL AND FABRICATION

A. Hangers: Steel cadmium plated.

B. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.

C. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.

D. Channels and Fittings:

1. Channels: Hot-dipped galvanized.
2. Fittings: Galvanized.

E. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable.

PART 3 - EXECUTION

3.1 USE

A. Use one-hole or two-hole straps for single conduit runs on walls or ceilings.

B. Use hangers with solid steel rods for hanging single conduits.

C. Use formed channel trapezes for groups of two or more conduits.

D. To fasten boxes and supports to:

1. Wood: Use wood screws or screw type nails of equal holding power.
2. Brick and Concrete: Use bolts and expansion shields.
3. Hollow Masonry Units: Use toggle bolts.

E. Support sheet metal boxes from building structure directly or by bar hangers.

F. Do not penetrate reinforced concrete beams with fastenings more than 1-1/2" or reinforced concrete joints with more than 3/4" fastenings to prevent contact with reinforcing steel.

END OF SECTION 16 190

SECTION 16 450 - GROUNDING

PART 1 - GENERAL

1.1 REFERENCES

A. N.E.C.: Article 250 "Grounding".

B. Underwriter's Laboratories (U.L.). Standard A67 - "Grounding and Bonding Equipment". STD 869 - Grounding and Bonding.

C. ITEE - Standards 142 and 241.

1.2 DESCRIPTION OF SYSTEM: A permanent grounding system with methods and materials in accordance with applicable Codes and Standards, able to conduct ground fault currents to the grounded neutral of electrical distribution systems, and limit potential differences between grounding conductors, raceways and enclosures.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on grounding systems and accessories.

B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

1.4 QUALITY ASSURANCE: Installer qualifies with at least 3 years of successful installation experience on projects with electrical grounding experience similar to that required for project.

1.5 DELIVERY, STORAGE, AND HANDLING: Handle electrical grounding accessories and components carefully to avoid damage. Store in location that will protect from dirt and weather.

PART 2 - PRODUCTS

2.1 GROUND RODS: Copper clad steel, unless indicated otherwise. Minimum dimension of 5/8" diameter by 8' long or larger if indicated and sectional rods with couplings where lengths exceeding 12' are specified or indicated, or where added driving depth is required to achieve a specified minimum resistance.

2.2 GROUNDING ELECTRODE: Bare stranded copper, 3/0 AWG unless indicated otherwise, for installation in soil or embedded in concrete and cable with type TW insulation when installed in raceway. Install without splice from connection to connection.

2.3 GROUNDING CONDUCTORS: Type TW insulation, unless specified or indicated otherwise with a continuous green outer insulating jacket for size #6 AWG and smaller and with green tape banding for #4 AWG and larger, marked at each access point (e.g.: Junction boxes, Enclosures).

2.4 CLAMPS AND PRESSURE CONNECTORS: Cast copper, copper alloy, or bronze alloy suitable for use with aluminum and copper. Double bolt type with formed shoe and "U" cable clamp for connection to pipe or conduit; Single bolt type with cable shoe and "U" clamp for connections to flat bar or metal; and double bolt, parallel conductor split clamp type for cable to cable connections.

2.5 WELDED CONNECTIONS: Exothermic process (Cadweld or Thermoweld).

2.6 EQUIPMENT ROOM GROUND TERMINAL BAR: Copper 1/4" X 2-1/2" X 24", unless otherwise indicated. Two rows of holes on 1-1/2" centers for 1/2" bolt, to receive cables from two directions.

PART 3 - EXECUTION

3.1 GENERAL: Ground conductive raceways, cable trays and enclosures for electrical systems wiring. Make ground circuits complete to form permanent conductive paths. Solidly ground each low voltage electrical system unless indicated or specified as ungrounded, or grounded through an impedance of a specified value. Provide bare conductors when in open air or soil and provide 600 volt, green, insulated conductors when in raceway.

3.2 MAIN GROUNDING JUMPER: Install a main grounding jumper between the system neutral and the enclosure ground bus (or directly to enclosure where ground bus is not present) at each location where system grounding is required. Main grounding jumper:

A. Formed bus in switchboards and panelboards.

B. Formed bus or copper cable in transformers not coupled in unitized assembly with distribution equipment.

3.3 GROUND CONNECTIONS: Make grounding electrode connections electrically ahead of any overcurrent or disconnect device or tap connection such that disconnection of neutral load conductors does not interfere with or remove the system ground connection. Use separate lugs on the transformer neutral terminals for neutral and main grounding jumpers when cable is used for transformer connections.

3.4 SEPARATELY DERIVED SYSTEMS: For each separately derived system, grounded or ungrounded, install a grounding electrode conductor between each system enclosure ground bus (or bolted connection to enclosure where ground bus is not present) and a cold water pipe or building structural steel of one (1) inch size or larger near the separately derived system ground connection. Make connections to water pipes or steel accessible for easy inspection. Provide a separate ground conductor for each audio, video, isolated panels and UPS as noted on the plans.

3.5 SERVICE GROUND: For each low voltage service, install a grounding electrode conductor between the system enclosure ground bus and the water service entrance to the building and install bonding jumpers around insulating unions and removable fittings in the water pipe between the grounding electrode conductor connection to the water pipe and the water service entrance.

3.6 GROUNDING ELECTRODE SYSTEM: Install a complete grounding electrode system with interconnecting cables and terminations at the equipment room ground terminal bar. Make connections to the grounding electrode system accessible. Install the following grounding electrode systems:

A. Metal frame of building.

B. Grounding electrode encased by at least two inches of concrete, within and near the bottom of the building foundation or footing of the type specified in Part 2 - Products, at least 20 feet in length without splice from connection to connection.

C. Connection of other metal piping systems as required by National Electrical Code Article 250.

D. Driven ground rods.

E. Driven steel piles.

F. Connection to water service with bonding jumper around water meter.

3.7 GROUNDING ELECTRODE CONDUCTORS: Install grounding electrode conductor in PVC or other non-conductive, non-metallic enclosure where a raceway system is indicated or necessary for conductor installation. Install grounding electrode conductors without splice from the enclosure ground bus to the connection at the grounding electrode system.

3.8 GROUND RODS: Install a vertical position, full length below grade unless specified otherwise, and with conductor and top of rod 6" minimum below grade. Provide exotheric welds at all connections.

3.9 EQUIPMENT ROOM GROUND TERMINAL BAR: Install in equipment rooms where indicated. Mount bar by anchors and bolts using 1-1/2" long segments of 1/2" rigid conduit as spacer between bar and wall. Use a minimum of two supports, 18" on center. Connect grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar. Label permanently all ground conductors as to destination location, e.g. TR1, panel IPS, etcetera.

3.10 EQUIPMENT GROUND: Form the equipment ground circuits with rigid metallic raceways (e.g., EMT, rigid steel conduit) unless indicated otherwise. Make all threaded coupling connections wrench tight. Install bonding jumpers for continuity around fittings and terminations where the conductive raceway is made non-continuous. Where indicated or specified, install ground conductors in raceways to augment the circuits formed by the metallic raceway system. Bond the conductors to boxes or enclosures in which access is possible. Size conductors as specified, indicated, or required by code, whichever is larger. Install grounding bushings and bonding jumpers to enclosures or ground bussing for the following: Service entrance feeder; each location where multiple ring knockouts are damaged during conduit installation; each location where conduits are stubbed up into floor mounted and each conduit termination at a painted enclosure where paint is not removed before installation of raceway.

3.11 FLEXIBLE RACEWAY GROUNDING: Install a ground conductor inside all flexible raceways (e.g., Flexible steel, liquid tight) regardless of length. Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated, or required by code, whichever is larger.

3.12 NON-CONDUCTIVE RACEWAY: Install a ground conductor in raceways of non-conductive materials. Bond conductor to conductive enclosures in which access is possible. Bond non-current carrying conductive equipment contained in a non-conductive enclosure. Install insulated or bare conductors, sized as specified, indicated, or required by code, whichever is larger.

3.13 SECTIONAL RACEWAY: Install a ground conductor in sectional raceways with removable covers for access (e.g., Plug-in strips, surface raceway systems, and wireways) unless specified otherwise. Size conductor in accordance with the N.E.C. for the largest phase conductor size installed in raceway, or as indicated. Bond sections of the raceway to the ground conductor. Connect receptacle ground terminals in the raceway to the ground conductor, and make other ground connections indicated on the drawings.

3.14 CABLE SUPPORT SYSTEMS: Ground elements of the cable support system to panelboards, cabinets and switchboards from which their circuits originate. Install a ground conductor sized as required by code, as indicated, or #12 AWG, whichever is larger.

3.15 MULTI-CONDUCTOR CABLE, METALLIC SHEATH: Use multi-conductor cable with metallic sheath or armor approved for use as ground circuit conductor or install ground conductor(s). Size ground circuit conductor as required by code, as specified, or as indicated on the drawings, whichever is larger. Terminating devices for cable using the sheath or armor as the ground circuit conductor shall be approved for use as the connecting device between the cable and the enclosure. Terminate internal ground circuit conductors by lug to the interior of the enclosure or to the contained ground bus where present. Use bare or clearly identified internal grounding conductors.

3.16 MULTI-CONDUCTOR CABLE, NON-METALLIC SHEATHED: Use only non-metallic sheathed multi-conductor cables having a ground circuit conductor enclosed in the sheath the same size as the ungrounded conductors. Use bare or clearly identified internal grounding conductors. Terminate ground circuit conductor by lug to the enclosure ground bus where present or to the interior of the enclosure.

3.17 GROUND CONDUCTOR BONDING: Bond grounding conductors to boxes or enclosures at each access point. Do not use building steel as equipment grounding path. Use welded ground connections, at least where such are buried in soil, installed below slabs on grade, or embedded in concrete.

END OF SECTION 16 450

SECTION 16 510 – LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Lighting fixtures, including lamps, accessories and support materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 16010.

B. Outlet and Junction Boxes: Section 16130.

C. Supporting Devices: Section 16190.

D. Contactors, Relays, Time Switches, Photocontrols, etc.: Section 16901.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Fixtures schedule lists one or more acceptable manufacturers for each fixture type.

B. Provide all lighting fixtures of each type from the same manufacturer.

C. Provide sockets for screw base lamps of plated steel, brass or bronze.

D. Lamps - Acceptable Manufacturers:

1. General Electric.
2. Phillips.
3. Sylvania.
4. As indicated for specialty lamps.

E. Flexible metal conduit systems connecting individual tandem wired lighting fixtures.

1. Conductors carrying line voltage and current shall be sized in accordance with the overcurrent device protecting the circuit indicated.
2. Provide a #12 AWG minimum size ground conductor.

F. Provide electronic ballasts for all fluorescent and HID fixtures and dimmable electronic drivers for all LED.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a lighting fixture for each lighting outlet indicated.

B. Provide recessed and semi-recessed fixtures with mounting frames compatible with the ceiling and wall systems employed and secure fixture mechanically to frame.

C. Align rows of suspended and surface mounted fixtures to form straight lines at uniform elevations.

D. Provide swivel ball-type hangers which will allow a minimum of 45 degrees angle for fixtures indicated as pendant mounted.

E. Make recessed fixture fit snugly against ceiling to prevent light leakage.

F. Support suspended and surface mounted fluorescent fixtures as follows:

1. Fixtures not over 12 inches wide and not over 50 inches long, a minimum of two fastenings.
2. Fixtures not over 12 inches wide and over 50 inches long, a minimum of three fastenings.
3. Fixtures over 12 inches wide and not over 50 inches long, a minimum of four fastenings.

G. Support pendant mounted fluorescent fixtures as follows:

1. Single fixtures not over 12 inches wide, a minimum of two single pendants.
2. Single fixtures over 12 inches wide, a minimum of two single pendants at each end or one double pendant at each end.
3. Continuous rows of fixtures not over 12 inches wide, a minimum of one single pendant for each fixture plus one for each row.
4. Continuous rows of fixtures over 12 inches wide, a minimum of two single pendants or one double pendant for each fixture plus one for each row.
5. Locate pendants for continuous row fixtures at each joint and each end of row.
6. Rigidly fasten continuous row fixtures together with fixtures manufacturer supplied joiner.

H. Provide each lighting fixture with the lamps indicated on the fixture schedule.

1. Provide self-extinguishing lamps in open-bottom or unshielded metal halide fixtures.

I. Clean and relamp existing fixtures to be reused.

J. EMT shall not be used to support suspended fixtures of any type. Suspension shall be by means of standard hangers, where available and applicable, by rigid threaded conduit and fittings, or by rods.

K. Where fixtures are to be mounted on, or suspended from concrete ceiling, provide cast-in-place inserts.

L. Fixtures shall not be supported by outlet box cover screws alone; provide a fixture stud or “hickey” for added support.

M. Provide a junction box at each exit light fixture indicated.

N. Provide weatherproof boxes and connectors and liquid tight flexible conduit to each light fixture.

O. All suspended fixtures will be installed with 1/8-inch safety cable and four Crosby clamps (two top and two bottom) to be used as a fixture support backup.

END OF SECTION 16 510

SECTION 16 721 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE & RELATED DOCUMENTS

A. The work covered by this section of the specifications include the furnishing of all labor, equipment, materials and performance of all operations associated with the installation of the Fire Alarm System as outlined. All items required to complete the installation whether detailed here in the specification or on the drawings shall be included in this contract.

B. The requirements of the conditions of the Contract, Supplementary Conditions, and General Requirements apply to the work specified in this section.

C. Related work in other sections or divisions:

1. Waterflow switches.
2. Sprinkler valve supervisory switches.
3. HVAC Systems Controls.
4. Electrical (Section 16000).

D. The entire installation, including materials and equipment shall meet or exceed the minimum standards and requirements of the following:

1. Underwriters Laboratory Inc.
2. California Building Code, Part 2, Title 24 (Current Edition).
3. California Building Code, Part 3, Title 24 (Current Edition).
4. California Building Code, Part 4, Title 24 (Current Edition).
5. California Fire Code, Part 9, Title 24 (Current Edition).
6. California Referenced Standards Code, Part 12, Title 24 (Current Edition).
7. Public Safety, Title 19, C.C.R. State Fire Marshall Regulations.
8. NFPA 72, Local Alarm Systems, (Current Edition).
9. Manufacturers Specifications.

1.2 Submittals

A. Contractor shall review the bid documents for completeness for the following items:

1. Building floor plan of each building drawn to 1/8” scale minimum. Building floor plan shall show location of all devices, conduit and interconnecting wires. Device symbols shall be the same as on the original bid set of drawings. Noted are all fire rated corridors, occupancy separations and area separation walls. Noted are all Room Identification Numbers/Use.

2. Site plan showing all buildings, conduit and interconnecting wires.

3. Complete symbol legend (same symbols as bid set), showing all symbols, wire, manufacturer, model number, backbox, mounting height and CSFM Listing Number.

4. Typical mounting height details.

5. Battery calculations with batteries used:

   Normal – 100% for applicable equipment and devices for a period of 24 Hours.

   Alarm – 100% for applicable equipment and devices for a period of 5 Minutes.

6. Typical fire penetration detail showing methods and codes used.

7. Wiring riser diagram including but not limited to, devices, wiring, zoning, EOL'S. etc.

8. Sequence of operations schedule.

9. General notes pertaining to this project.

B. The following shall be included in the submittal book:

1. Cover Sheet: Project Name, Project Location, Architect/Engineer of Record, System Supplier, System Installer with C-10 License Number and Expiration Date.
2. Table of Contents: Page numbers of all specification sheets and CSFM Listing Numbers.
3. Specification Sheets for each piece of equipment.
4. CSFM Listing Sheets. (Currently Certified)

1.3 EQUIPMENT QUALIFICATION

A. The specification is based upon equipment as manufactured by the building Standard System as approved by the School. The equipment specified is a School Standard and therefore NO SUBSTITUTIONS will be allowed on this project.

B. All equipment shall conform to all applicable codes and ordinances, and shall be listed by Underwriters Laboratories and the California State Fire Marshal.

C. Equipment supplier, installer & programmer shall be a manufacturers EST Strategic Partner.

1.4 QUALIFICATION OF BIDDERS

A. To qualify as an acceptable bidder, whether the bid is submitted to the Owner, his agent, a general contractor or a sub-contractor, the system bidder or sub-contractor shall be qualified U.L. Listed Fire Alarm Contractor at time of bid and shall hold a valid C-10 License issued by the Contractors State License Board of California. The contractor shall also have on staff a minimum of 1 Nicet Certified Technicians (at time of bid). The system bidder or installing

contractor shall herein be referred to as the Contractor. The Contractor shall also hold a State of California Consumer Affairs License – Bureau of Collection and Investigative Services. This is to insure that licensed installers familiar with this type of installation will be used on this project. The Contractor shall be the factory authorized distributor & Strategic Partner for the brand of equipment being installed. The Contractor shall have been in the business of supplying, installing and servicing Addressable Fire Alarm Systems for the past 5 years, in the State of California. The Contractor shall be able to refer to at least 20 projects of this nature rendering satisfactory service with contact persons, phone numbers and addresses. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain an inventory of all major components in stock at all times. The Contractor shall maintain on staff for the duration of the project a minimum of one Certified Installer. Contractors not pre-approved in writing 21 days prior to bid hour and date will not be considered for this project.

B. The responsibility of the installing Contractor is to provide all drawings, submittals, wire, devices, equipment, installation to conduit system furnished and installed under Section 16000, programming, final test out and certification. All specialty Fire Alarm Backboxes for the conduit system provided under Section 16000 shall be provided under this section.

PART 2 - SYSTEM LAYOUT

2.1 SYSTEM DESCRIPTION

A. The Fire Alarm System as outlined on the drawings shall be a Life Safety System as manufactured as noted on plans. It shall be complete with all necessary hardware, software and memory specifically tailored for this project. The project shall also include reprogramming of the existing site remote annunciator which will include all necessary software, devices and components for a complete and operable system.

B. Provide New Fire Alarm Control Panel, Remote Panels, Remote Annunciators, Printers, Devices, etc. in accordance with specifications and drawings. Counts for devices to be in accordance with engineers drawings.

C. All equipment needed for a complete operable system, (whether specifically indicated or not) shall be included in this section. It shall be the Installing Contractors responsibility for a COMPLETE AND OPERABLE SYSTEM upon completion of this project.

D. Control panel to be a Network connectable system to the campus wide system.

2.2 AUTOMATIC ALARM OPERATIONS

A. The system alarm operation subsequent to the alarm initiation via pull station, smoke detector, heat detector, sprinkler flow switch, etc., shall be as follows:

1. All audible alarm indicating devices shall sound the Temporal Signal Code, until silences at the control panel or at the remote annunciator.

2. All visual alarm indicating devices shall flash per NFPA requirements until reset at the control panel or at the remote annunciator.

3. Alarm audible devices and alarm visual devices shall operate independently of each other.

4. The audible alarm signals shall be inhibited from being silenced for a period of at least 1 minute after commencing operation. This rate is to be field programmable for actual AHJ requirements.

5. Display type and location of alarm on the Main FACP LCD display.

6. Display type and zone of alarm on Remote LCD Annunciator.

7. List on printer the time, date, type and user defined message for each event printed.

8. Subsequent alarms are to report to the FACP and indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.

9. Shut down all associated air handlers in Alarm Zone.

2.3 AUTOMATIC SUPERVISORY OPERATION

A. All data, initiating, indicating and supervisory lines shall be constantly monitored for Integrity. Indicate opens, shorts, grounds, at Main FACP and Remote Annunciator.

2.4 OPERATION

A. During the normal state, the NORMAL LED (green) shall flash. The first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points (AP) and the number of disabled points (DP) in the system.

B. When the control panel goes into alarm condition, the NORMAL LED (green) extinguishes and the ALARM LED (red) shall light, the buzzer pulsates and the LCD indicates the time, the number of messages waiting, the type of alarm, the alarm zone or device number, and the time that the alarm occurred. The second line is dedicated to the user specified message.

C. To acknowledge the alarm, the operator shall press the LOCAL SILENCE button and the buzzer will silence providing there isn't an additional alarm waiting.

D. To silence the audible devices, the operator shall press the ALARM SILENCE button. A new alarm shall cause the audibles to resound.

E. During the TROUBLE condition, the amber TROUBLE LED shall light, the NORMAL LED shall go out, and the buzzer shall pulsate. The display shall indicate the type of event, the time the event occurred and up to a 40 character customer user description.

F. During the MONITOR or SUPERVISORY condition, the appropriate LED shall light, the NORMAL LED shall go out, and the buzzer shall pulsate. The display shall indicate the type of event, the time the event occurred and up to a 40 character custom user description.

PART 3 - MATERIALS

3.1 MAIN FIRE ALARM PANEL

A. Control Panel construction shall be modular with solid state, micro processor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or Keypads shall not be required to operate the system during fire alarm conditions.

B. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall sound differently at each condition, to distinguish one condition from another without having to view the panel.

C. Primary Keys, LED's, LCD Display

1. The following primary controls shall be visible through a front access panel:

Eight Line by 21 Character LCD display
Individual System ALARM LED and Switch
Individual SUPERVISORY LED and Switch
Individual TROUBLE LED and Switch
Individual MONITOR LED and Switch
Individual ALARM SILENCE LED and Switch
Individual PANEL SILENCE LED and Switch
Individual RESET LED and Switch
Individual DRILL LED and Switch
Individual LED'S FOR Power, Test, CPU Fail, Ground Fault, Disable NEXT/BACK Switch Per Condition.

D. The Master Controller shall be capable of supporting up to 64 supervised system nodes per single line network without any change in hardware. Each controller shall contain RS-232 Printer/Programming Port for programming locally via a PC.

E. Each controller shall support up to 10 Intelligent Loop Cards (SCDs). Each card shall support (125) Intelligent Sensors and (125) Intelligent Modules. Each sensor shall respond to a panel poll for information with an analog representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end to end sensor response including the operation of the sensor electronics. Systems which only monitor the presence of a conventional detector in an addressable base shall not be acceptable.

F. The Master Controller shall have the following additional features without any changes in hardware or firmware:

1. Auto Programming and Electronic Addressing of Field Devices.
2. Logic Statements.
3. Time Controls.
4. Sequences.
5. Actions.
6. Analog Value Reporting of all analog sensors and traditional zones.
7. Maintenance Reporting by Intelligent Sensor.
8. Sensitivity Setting by Sensor (Within UL Limits).
9. Sensitivity Setting changed by time (Day/Night Mode).
10. Alarm Verification by point or zone (0-60 Seconds).
11. Print a history of Sensors Activating the Verification Cycle.
12. On demand system condition printouts (status).
13. Enabling and Disabling of any system device or function.
14. Ground Fault Detection by Panel, by Signature Data Circuit, and by device module.
15. Normal and Silent One Man Test.
16. Windows Based Programming.
17. Network Response Time Under 3 Seconds.
18. Loop Response Time under 750 Milliseconds.
19. Device Mapping Feature for As-Builts.
20. Up to 1750 History Events.

3.2 REMOTE ANNUNCIATOR

A. Remote Annunciator to accommodate all buildings for the Fire Alarm System. Annunciator zoning shall have the following displays as a minimum:

1. Type of device per building/per floor or section.
2. Zone of type of device per building/per floor or section.
3. Common control features.

B. The remote annunciator shall contain the following:

1. 8 Line by 21 Character LCD Display.
2. Individual System ALARM LED and Switch
3. Individual SUPERVISORY LED and Switch
4. Individual TROUBLE LED and Switch
5. Individual MONITOR LED and Switch
6. Individual RESET LED and Switch
7. Individual ALARM LED and Switch
8. Individual TROUBLE LED and Switch
9. Individual DRILL LED and Switch
10. Individual LED’S FOR Power, Test, CPU Fail, Ground Fault, Disable

3.3 PRINTER

A. Provide for printer port for the life safety system FACP to connect to printer.

3.4 SIGNATURE SERIES DEVICES - GENERAL

A. Each remote device shall have a microprocessor with non-volatile memory to support its function and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, number of alarms and troubles, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.

B. Dependent on its functionality, each device shall be capable of monitoring up to 32 diagnostic codes. This data shall be stored at the device and available for system maintenance.

C. Each device shall be capable of performing its intended function dependent of the control panel, to lower loop data traffic. Each device shall immediately alert the loop controller of a status change to achieve a loop response time of less than 750ms.

D. Each device shall be capable of electronic addressing, either automatically or application program designed, to support physical/electronic mapping and supervision by location. Setting a device's address by physical means shall not be necessary.

3.5 ANALOG PULL STATIONS

A. Provide pull stations as indicated on the drawings.

B. Pull station shall be double action with terminals for field wiring. Pull station shall be constructed of Red Lexan with White Letters, Key resettable with break glass rod.

C. Station shall be equipped with a Protective Cover w/horn where noted.

3.6 ANALOG SMOKE DETECTORS

A. Provide Intelligent Multi-Sensor Detector where indicated on the drawings.

B. Units shall incorporate three (3) sensing technologies. It shall process and analyze information from each technology (ion/photo/heat) separately using dynamic filters, then apply a sophisticated algorithm for optimum detection accuracy.

C. Each sensing element self-compensates for changes in the detectors installed environment to maintain the sensitivity setting and prevent unwanted alarms. The detector reports when it cannot compensate any further.

D. Units shall incorporate twin status LED's. Flashing green shows normal; flashing red shows alarm state; steady red and steady green show alarm state in stand alone mode, visible from any direction.

E. Units shall incorporate a stand alone operation mode. The detector makes decisions and inputs an alarm even if the loop controller fails. The detector reverts to an intelligent “conventional” detector when polling interrogation stops.

F. Units shall mount to the SIGA-SB, SIGA-RB or SIGA-IB bases as required.

G. Base shall mount to a 4S 2-1/8” box with 3-0 ½” ring. (Furnished and Installed under Section 160000).

3.7 DUCT SMOKE DETECTORS

A. Provide Duct Smoke Detectors where indicated on the drawings.

B. Duct Housing shall be constructed of 16 gauge metal. Units shall incorporate the SIGA-IPHS sensor, base as required and sampling tubes as required for duct width.

C. Each air handling unit shall be equipped with a Control relay for shut down of that particular unit. The duct smoke detector shall be correlated through programming to the control relay for this operation. Mounting box for control relay to be furnished and installed under Section 16000.

D. Duct Housing, Detectors, Sampling Tubes and Control Relays are to be supplied as required.

E. Duct Housings, Sampling Tubes and Control Relay Backboxes are to be installed as part of the conduit system.

3.8 PHOTOELECTRIC SMOKE DETECTORS

A. Provide Photoelectric Smoke Detectors where indicated on drawings.

B. Detectors on-board micro-processors measures and analyzes digital signals gathered by the smoke sensing element. It compares the information to historical readings and time patterns to make an alarm decision. Unwanted alarms are nearly eliminated.

C. The microprocessor in each detector provides Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

D. Units shall mount to the bases as required.

E. Base shall mount to a 4S 2-1/8” box with 3-0 ½” ring. (Furnished and installed under Section 16000).

3.9 HEAT DETECTORS

A. Provide Heat Sensors where indicated on the drawings.

B. Detectors shall gather analog information from their fixed temperature and/or rate-of-rise heat sensing elements and convert it into digital signals. The detectors on board microprocessors

measures and analyzes these signals. It compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.

C. Units shall incorporate twin status LED's. Flashing green shows normal; flashing red shows alarm state; steady red and steady green show alarm state in stand alone mode, visible from any direction.

D. Units shall mount to bases as required.

E. Base shall mount to a 4S 2-1/8" box with 3-0 ½" ring. (Furnished and installed under Section 16000).

3.10 ATTIC HEAT DETECTORS

A. Provide Heat Detectors where indicated on the drawings.

B. Units shall incorporate single pole, normally open contacts and a SIGA-CT1 Monitor Module.

C. Fixed Temperature Rating shall be 194 Degrees Fahrenheit.

D. Units shall mount to a 4S 2-1/8" box with 3-0 ½" ring. (Furnished and installed under Section 16000).

E. Monitor modules shall mount to a 4S 2-1/8" box with 1G ½" ring. (Furnished and installed under Section 16000).

3.11 STROBES

A. Provide Strobes as indicated on the drawings.

B. Strobes shall be rated 15cd, 30cd, 75cd or 110cd or as noted on plans as required. Strobes shall be synchronized and equipped with an interchangeable wall or ceiling lens as required. Strobes shall be capable of being on the same circuit as audibles, be synchronized and flash per NFPA requirements. Units not capable of this feature shall have separate audible and visual circuits, conductors, synchronization modules, etc. Strobes shall be listed for indoor applications. Units shall be rated for 24VDC polarized operation. Units shall be red in color and mount to a single gang opening.

C. For flush mount applications indoor – Use 4S 2-1/8" boxes with ½" Single Gang Ring. (Furnished and Installed under Section 16000).

3.12 HORNS

A. Provide Horns as indicated on the drawings.

B. Horns shall be rated 94dBA – low and 98dBA – high. Units shall incorporate a high and low setting position. Units shall be rated for 24VDC polarized operation. Units shall have screw terminals for input/output wiring, be red in color and be suitable for indoor or outdoor applications. Units shall be capable of being installed on the same circuit as visual devices and shall sound the Temporal Code in synchronization with all units. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc.

C. For flush mount applications indoors - Use 4S 2-1/8" box with 4S 1-1/2" Extension Ring. (Furnished and installed under Section 16000).

D. For surface mount applications indoors – Use Backbox (Furnished under Section 16720, Installed under Section 16000).

3.13 HORN/STROBES

A. Provide Horns as indicated on the drawings.

B. Horn (strobes) shall be rated 94dBA – low and 98dBA – high. Units shall incorporate a high and low setting position. (Horn) STROBE to be rated at 15cd, 30cd, or 110cd as required. Units shall be rated for 24VDC polarized operation. Units shall have screw terminals for input/output wiring, be red in color and be suitable for indoor or outdoor applications. Units shall be capable of being installed on the same indicating circuit and shall sound the Temporal Code in synchronization per NFPA requirements. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc.

C. For flush mount applications indoors - Use 4S 2-1/8" box with 4S Extension Ring. (Furnished and installed under Section 16000).

D. For surface mount applications indoors – Use Backbox (Furnished under Section 16000, Installed under Section 16000).

E. For surface mount applications outdoors – Use Backbox (Furnished under Section 16000, Installed under Section 16000).

3.14 MONITOR MODULES

A. Provide monitor modules as indicated on the drawings.

B. Units shall permanently store serial number, type of device, and job number. Each module shall be capable of having its own personality code. Use respected module for particular application. Modules shall use electronic addressing. Use of switches to set address will be prohibited.

C. Module for flush or surface mountings – Use 4S 2-1/8" Boxes with ½" One Gang Ring (Furnished and Installed under Section 16000).

3.15 CONTROL MODULES

A. Provide control modules as indicated on the drawings.

B. Units shall permanently store serial number, type of device, and job number. Each module shall be capable of having its own personality code. Use respected module for particular application. Modules shall be electronic addressing. Use of switches to set address will be prohibited.

C. For flush or surface mount applications – Use 4S 2-1/8" boxes with (1) Two Gang Ring (Furnished and Installed under Section 16000).

PART 4 - EXECUTION

4.1 INSTALLATION

A. Wiring shall be installed in conduit specified under the electrical section of the specification (Section 16000).

B. The sum of the cross-sectional areas of individual conductors shall not exceed 40% of the interior cross sectional area of the conduit. Minimum conduit size shall be ¾ inch trade size.

C. Wiring shall be identified at terminal and junction locations to prevent unintentional interference with the circuits during testing and servicing.

D. Junction, pull and terminal boxes/cabinets shall be labeled. Labels shall be permanently affixed to covers/doors. Labeling to be Furnished and Installed under Section 16000.

E. Wiring color code shall be consistent throughout the system and shall allow for easy identification of initiating, indicating and auxiliary control circuits.

F. Wiring at building terminal cabinets shall be terminated to screw barrier strips, with circuits identified.

G. Wiring in control, terminal and junction cabinets shall be neatly arranged and bundled.

H. Wiring shall test free of earth grounds or shorts between conductors.

I. The contractor shall be responsible and assure the use of adequate numbers of skilled workmen, who are thoroughly trained and experienced, and completely familiar with the specified equipment and code requirements.

J. The contractor shall be responsible for assuring that conduit size, wire type and color coding meet the specification, manufacturers and code requirements.

4.2 SYSTEM VERIFICATION

A. Upon completion of the installation, the fire alarm contractor shall place into operation and test all operational features, functions and devices.

B. Upon completion of testing and after the system has been in operation for a minimum of 5 days without failure, the fire alarm contractor shall schedule with the Authority Having Jurisdiction & Engineer, a demonstration and field acceptance test.

C. Field acceptance and approval of the fire alarm system shall be evidenced in writing by the Authority Having Jurisdiction.

D. Prior to scheduling field acceptance, the fire alarm system contractor shall certify in writing, and record the method of testing, the results of all tests and certify that the system has been in operation a minimum of 5 days.

E. All testing shall be conducted in accordance with NFPA-72H, contract documents, manufacturer's instructions and per the requirements of the Authority Having Jurisdiction. Provide all required NFPA-72 documentation.

F. Provide software and hardcopy of all programming in addition to password to owner per NFPA-72.

4.3 GUARANTEE AND SERVICE

A. Fire alarm system contractor shall provide written guarantee for all fire alarm equipment and devices used on this project for a period of one (1) year from the date of final acceptance.

B. During the guarantee period the contractor shall repair or replace any defective material at no additional cost to Owner.

4.4 IN SERVICE TRAINING

A. The fire alarm contractor shall provide factory trained representatives to demonstrate the operation of the fire alarm system to the Owner's personnel. The representative shall have a thorough knowledge of the equipment and operation of the system. The contractor shall provide one (1) 4 hour in-service training session.

B. The fire alarm contractor shall provide to the Authority Having Jurisdiction a demonstration of the system operation. Sessions shall consist of one (1) 4 hour in-service training.

4.5 OPERATION MAINTENANCE MANUALS

A. The fire alarm contractor shall provide to the Engineer, three (3) weeks after the field acceptance test, two (2) sets of operating/maintenance manuals and one (1) set of as-built drawings.

B. As-built drawings shall indicate the location of all devices, appliances, coding, zoning, wiring sequences, wiring methods, color coding, identification, labeling and connections of the components of the fire alarm system as installed.

END OF SECTION 16 721

SECTION 16 745 – NETWORKING AND DATA COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. SCOPE

1. This section outlines the requirements for the Local Area Networks system switches, system hubs, networking modules (transceivers) and connectivity at the IDF.

2. Administrative Network

a. The distribution components will be located in telecom room IDF. The system is connected via CAT 6 (as noted on the plans) cabling to various server and workstation locations throughout the building.

b. The contractor will be responsible to install, program, test and document the system as installed, verifying throughput rates.

c. The contractor will be required to work in close coordination with the owner's information systems director and staff.

1.2 WORK INCLUDED

A. Furnish and install all required system switches, system hubs, system 100/1000BASE-T modules, transceivers, patch cables and accessories for a complete system.

B. The installation shall include interconnect/patching equipment (fiber and copper), jumpers (optical fiber and twisted-pair copper), hub & switch equipment, optical fiber transceivers, routers, asynchronous controllers, optical fiber transceivers, and any other equipment enumerated within. In addition to material and equipment, contractor shall provide labor and any incidental material required for installation. All active equipment shall be installed and connected to the cable system.

C. Configuration, programming and testing of the local area networks.

D. New local area network locations are listed on the drawings.

1.3 RELATED DOCUMENTS

1.4 FUNCTIONAL REQUIREMENTS

A. Transmission Media. The example LAN will use both twisted-pair and fiber optic cable plant to provide connectivity between user workstations located in offices and network resources located in the facility computer room(s).

B. Host/Server Access. The network will allow users to access all host/server resources, including future application servers, such as additional database servers. There should be full compatibility with existing initiatives (e.g., a new financial system, security system, and telephone and employee services database repository).

C. Outside Communications. The network will need to support future access to external networks through routers. These communications will use the Transport Control Protocol/Internet Protocol (TCP/IP) protocol.

D. Environment/Facility Considerations. The network architecture design must take into account existing space, power, and heat constraints.

E. Flexible Architecture. The design must have sufficient flexibility to permit grouping users into distinct "workgroups" for office automation services. Physical features, such as a layered distribution scheme, redundant patching, and real-time configuration and topology modifications, will be included in the design. The overall transition strategy should minimize downtime and denial of service.

F. Office Automation Services. The network will support a broad range of office automation services for DOS, Windows, and Macintosh workstations. The following services will be provided:

1. File storage and retrieval;
2. Network printing;
3. Support of commercial off-the-shelf (COTS) desktop applications (in the DOS, Windows and Macintosh environments), including electronic mail and calendaring; and fax services.

1.5 Operational Requirements

A. Network Management. The design will contain methods and tools for the efficient management and control of the network. The capability to monitor and manage both network traffic and physical components of the network will be provided.

B. Fault Recovery. The design will include contingency or back-up plans should any element of the network fail.

1.6 Performance Requirements

A. Network Response. The servers and other components of the network must be sized to avoid unacceptable start-up delays when workstations are first activated, long login times, and slow response during normal network utilization (e.g., application startup and exit, file retrieval and save operations). Response times for network desktop applications should not be significantly greater than stand-alone usage.

B. Network Availability. The users must be able to access the network 24 hours a day, seven days a week unless specifically made unavailable at organization discretion (e.g., for administrative or maintenance activities).

1.7 Network Capacity. Individual components of the network will be sized as indicated below:

A. The cable plant -- The cable plant will provide for approximately 150 cable drops distributed throughout the offices and facility.

B. User workstations -- Initially, service will be provided for approximately 50 local users. However, when fully operational, the network will be capable of supporting approximately 150+ local users (150+ Windows-based PCs and servers).

C. Intelligent hub equipment -- All hub equipment will be sized to support all ports plus 25% spare ports for growth.

1.8 REFERENCES AND STANDARDS INCORPORATED

A. Published specifications, standards, tests or recommended methods of trade, industry or government organizations apply to work of this section where cited by abbreviation noted below:

1. EIA Electrical Industries Association
2. IEEE Institution of Electrical and Electronics Engineers
3. ISO International Standards Organization
4. ITU International Telecommunications Union
5. CCITT Consultative Committee of International Telegraph and Telephone
6. ANSI American National Standards Institute
7. TIA Telecommunications Industry Association
8. ASTM American Society for Testing and Materials
9. NEC National Electric Code
10. FCC Federal Communications Commission
11. CEA Insulated Cable Engineers Association, Inc.
12. IEC International Electrotechnical Commission
13. NEMA National Electrical Manufacturers Association
14. UL Underwriters' Laboratories, Inc.
15. IPC The Institute for Interconnecting and Packaging Electronic Circuits
16. NFPA National Fire Protection Association
17. BICSI Building Industry Consulting Service International

B. Nothing in the drawings, details, or specifications shall be construed to permit work not conforming to applicable laws, ordinances, rules, or regulations and standard industry IEEE 802 Ethernet standards.

C. It is not the intent of the drawings, details, or specifications to repeat requirements of codes except where necessary for completeness or clarity.

1.9 SUBMITTALS

A. Submit manufacturer's data literature for each item used describing each product, including specification, installation instructions and general recommendations.

B. Submit manufacture's data literature on system hubs, switches, 100/1000BASE-T modules, 100/1000BASE-FB modules, 100/1000Base2 modules, power supplies and accessories.

C. As per section 16010 - General drawings, submittals and shop drawings.

D. In addition to the requirements of Division 1, submit all materials for approval, arranged in same order as specifications, individually referenced to specification paragraph and drawing number. Submit number required in Division 1 plus three (3) copies of 8 1/2” x 11" material and 2 prints and one reproducible of drawings in 24” X 26” size, minimum. Submit 8 1/2” x 11” items bound in volumes and 24” X 36” drawings in edgebound sets.

E. Progress Schedule: Include duration and milestones for the following:

1. All submittals specified.
2. Completion of equipment buyout.
3. Completion of equipment receipt at fabrication shop.
4. Shop fabrication.
5. Shop testing.
6. Shipment to site.
7. Installation.
8. Field testing.
9. Training.
10. First use date.

F. Manufacturer's Product Data:

1. List of Materials: For each item include:

a. Manufacturer.
b. Model number.
c. Listing: UL, City Lab or none.
d. Quantity.

2. Manufacturer's Product Data: In sequence of list of materials, data sheet for each item, including all accessories, marked for proposed product.

G. Field and Shop Drawings:

1. Resubmit: for coordination reference complete with corrections from previous submittal:

   a. List of Materials.
   b. Manufacturer's Product Data.

2. Field (installation) Drawings: collate in sequence:

   a. Drawing index/symbol sheet.
   b. Floor plans. At scale of contract documents. Show:

      1) Devices with circuit number.
      2) Rough-in.
      3) Mounting height.
      4) Conduit size.
      5) Wire type.
      6) Wire fill.

   c. Sections/Elevations. At scale of contract documents.

      1) Mounting location reference.

   d. Enlarged Plans. At scale of contract documents or larger as required for trade coordination. Show:

      1) Refer to floor plans.
      2) Architectural features.
      3) Rack cabinets.
      4) System furniture.
      5) Clearances.

   e. System conduit riser drawing, show:

      1) Terminal cabinets.
      2) Coordination with floor plans.
      3) Wire runs not shown on floor plans.
      4) Wire type.
      5) Wire fill.

   f. Mounting details

      1) Stamped and signed by engineer licensed in jurisdiction for work of this type.
      2) Show loads, strength of connections, etc.
      3) Show calculations - on drawings or in bound volume for review by authorities having jurisdiction.
      4) Provide details for:

a) Racks.

5) Installation details as required.
6) Terminal cabinets: terminations.

g. Wire run sheets (if used) show:

1) Wire number.
2) Source.
3) Designation.
4) Signal type.
5) Wire type.
6) Operating level or voltage (if applies).

h. Shop and Field Test Reports

3. Schedule: Submit test reports in timely manner relative to project schedule such that owner may conduct verification of submitted test data at owner's option, without delay of progress.

a. Shop test report: Submit prior to shipping completed system to project site.
b. Field test report: Submit following system completion and prior to and as condition precedent to owner's acceptance of the work of this section.

4. Test Reports: Include:

a. Time and date of test.
b. Personnel conducting test.
c. Test object.
d. Procedure used.
e. Test equipment, including serial and date of calibration.
f. Results of test - numerical or graphical presentation.

5. Verification of submitted test data: Owner may elect to verify some or all test data submitted. Retest in presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this section. Provide all test equipment.

H. Reference Data for Operation, Maintenance and Repair

1. In addition to the requirements of Division 1, submit 3 sets. Submit in three post binders (not ring binder) with tabs.

a. Index.
b. Systems operating instructions.
c. Reduced set of system record drawings.
d. Key schedule.

e. Maintenance and spare pans schedules.
f. Shop and Field Test Reports.
g. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

I. Record Drawings in AutoCAD R2014 format

1. Quantity:

a. Review sets: as for shop and field drawings.
b. Record set:

1) Three (3) bluelines.
2) One CD with applicable .DWG files as full scale

c. Content: All drawings required under “Field and Shop Drawings”. Show as installed condition.

PART 2 - PRODUCTS

2.1 GENERAL

A. Quality of Products: Material and equipment specified herein have been selected as the basis of acceptable and desired quality of performance and have been coordinated to function as components of the specified system. Where a particular material, device, piece of equipment of system is specified directly, the current manufacturer's specification for the same shall be considered to be part of these specifications, as if completely contained herein in every detail. Each material, device, or piece of equipment provided hereunder shall comply with all of the manufacturer's published specifications for that item.

B. Quantity: Provide quantity as shown on contract drawings, the schedule or as otherwise defined herein.

C. Preference: Owner desires system to be furnished and installed as specified herein.

D. Substitutions: Comply with SECTION 16010 -GENERAL CONDITIONS.

E. Provide complete: Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the work of this section at, if specified in full herein.

F. Provide new: All materials provided under the work of this section shall be new, shall be the manufacturer's latest design/model, and shall be permanently labeled with the manufacturer's name, model number and serial number.

G. Similar: Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

H. Continuous Use: All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

2.2 MANUFACTURERS

A. NETWORKING HARDWARE

1. System design is based on products as manufactured by Cisco, 3Com or BayNetworks Substitutions must be pre-approved according to Sectin 16010 and general conditions.

B. SYSTEM SPECIFICATIONS

1. LOCAL AREA NETWORK

a. The Local Area Network shall be based on and support IEEE 802.3 functional standards for EtherNet Local Area Networking. This shall include IEEE 802.3 100/1000BASE-T and 100/1000BASE-T for station microcomputers, and IEEE 802.3 100/1000BASE-F or 100/1000BASE-F (FIORL) synchronous technology for fiber optic repeater interconnection.

b. The main distribution frame (MDF) and all intermediate distribution frames (IDF's) shall support one EtherNet segment per network.

c. System shall be sufficient to support use at full capacity without user-perceptible delays in network response time.

d. System shall be sufficient to support any combination of system features at full capacity. System shall allow reconfiguration of backbone to allow Customer maximum flexibility and implementation of options in case of need when future services are identified and added.

C. LAN CONFIGURATION

1. System hubs are required in DESIGNATED zones so that every data drop on site can be serviced by a hub.

2. Each system hub shall allow for growth, without the need to add an additional hubs to 125% of the current data drop count for the area of the campus that it serves even though all those drops will not be connected at initial installation.

3. Each designated location shall utilize a system hub as per the specification.

4. Each hub location shall utilize fiber optic transceiver module for connection to the fiber optic backbone or horizontal distribution (where fiber is utilized as the backbone or horizontal media).

5. Each hub location shall utilize 100/1000BASE-T(RJ45), 100/1000BASE-T (RJ45), unshielded twisted pair ports for connection to the UTP CAT 6 LAN cable plant or 100/1000BASE-2 ports for connection to the ThinLAN cable plant. The quantity of initially installed 100/1000BASE-T/100/1000BASE-2 ports shall be per the needs indicated and requirements of this specification and contract drawings.

6. The initially active 100/1000BASE-T, 100/1000BASE-T locations shall be connected to the system Hubs via CAT 6 UTP patch cords and patch panels. If Telco style 100/1000BASE-T modules are utilized in the system Hub then CAT 6, Telco-to RJ45 patch panels shall be installed with the appropriate cable to the hub for full connectivity.

2.3 MATERIALS AND EQUIPMENT

A. SYSTEM HUBS

1. The Local Area Network shall be created from a family of intelligent, or "smart," switches, hubs and related products. The product family shall consist of various hubs; numerous plug-in EtherNet, FDDI, and internetworking modules for these hubs, and network management software. These products shall enable the customer to create a large-scale facility network that is flexible, reliable, and manageable.

2. The System shall have port switching technology that shall offer remote network configuration and management capabilities.

3. The System's network management shall support network analysis, identify specific network problems, and correct or self-heal problems dynamically. The system's network management shall not be a passive traffic monitoring tool.

4. System hubs shall have the following parameters and features:

   a. Modular Multi-Media Chassis.
   b. Supports SNMP Based Network Management System.
   c. Supports Inband and Out of Band Network Management.

5. Specific EtherNet features required:

   a. Supports Shielded/Unshielded Twisted Pair, Coax, AUI & Synchronous Fiber.
   b. Supports Internal EtherNet Terminal Servers for TCP/IP.
   c. Supports Fiber Links Up to 2.0 Kilometers.

6. System hub shall be provided in 12, 24, or 48 port versions. The system hub shall be able to be mounted in a rack and installed from the front.

7. Transceiver slots for connection of twisted pair 100/1000Base-T, Thin LAN or fiber optic FIORL.

8. The unit shall include and Intel I960 RISC-based processor, 1 Mbytes of RAM and 256Kbytes of flash EEPROM.

9. Complete workgroup security including: intruder prevention, auto port disabling, network management alarm, eaves drop prevention, authorized managers list and password protection.

10. Provisions for added SNMP management module.

11. Intelligent error monitoring, intelligent segmentation recovery, auto-segmentation, fault isolation and integrity.

12. Support for SNMP/IP and IPX multi-vendor management with SNMP browsers.

13. The unit shall be UL rated and meet FCC Part 15 Class A emissions standards.

14. The unit shall be provided with a lifetime limited, 5 year on site warranty.

15. The system hub must be capable of implementation to include all of the following features:

    a. A single-port FOIRL module shall be available to provide FOIRL-based EtherNet connections through the system hub. The module shall comply with the IEEE FOIRL and 100/1000BASE-FL and 100/1000BASE-FL standards which ensures interoperability with other vendors' FOIRL-compliant devices. In addition, users in a FOIRL environment shall be able to take advantage of the system hub benefits such as multi-channel architecture, port redundancy, and fault tolerance.

    b. The FOIRL module shall achieve point-to-point connections longer than the 1 kilometer specified by the IEEE FOIRL specification by use of high power optics.

    c. A FOIRL transceiver shall be available to link a network station to EtherNet 100/1000BASE-FL LANs using fiber-optic cable. The FOIRL transceiver shall attach directly to the AUI port on the network station eliminating the need for an AUI cable.

        1) The FOIRL transceiver shall comply with the IEEE 802.3100/1000BASE-FL draft standard and offers low-light level detection for error-free transmission.

16. An EtherNet transceiver module shall be available to provide AUI connectivity to the system hubs.

17. An EtherNet BNC module shall be available to provide a single connection to thin-wire EtherNet segments up to 185 meters in length.

    a. The BNC module shall be fully compliant with the IEEE 100/1000BASE-2 standard. All thin wire segments shall be able to be terminated either internally or externally.

B. Approved Suppliers

1. The following vendors have been pre-approved to supply product under this contract:

    a. Cisco
    b. 3Com
    c. Bay Networks
    d. Others submit in accordance with substitution requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide installation logs supporting building infrastructure.

B. Configure and cross connect all ports as required for complete end to end system.

3.2 DRAWING DETAILS (Shop Drawings)

A. Show wall elevation and wire details on shop drawings. Show equipment function, make and model and wire routing and terminations within rack or cabinet.

B. Show as-built location of all devices on shop drawings.

C. Provide 3 sets of bound operation and maintenance manuals, including submittal materials, and record of field changes. Provide complete as-built wiring diagrams in AutoCAD2014 format. Provide CD files and original tracings (E size) in format of construction drawings. Input all cabling information into ACS system and provide a detailed printed report with as-builts.

3.3 QUALITY CONTROL

A. Evidence of Experience and Qualifications

1. Show that the contractor who will perform the work has a minimum of 5 years experience successfully installing system of the same type and design as specified herein. Include the names, locations, and points of contact of at least two similar installations of the same type and design as specified herein where the installer has installed such systems.

Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months.

2. Show that the instructor, who will train staff, operating and maintenance personnel, has received a minimum of a CNE/MCE training from a factory training center, and 2 years experience in the installation of systems of the type specified. Submit training certification in equipment submittals, title section training and certifications.

3.4 TESTING

A. GENERAL

1. Testing shall be performed in the presence of the owner.

    a. Testing shall include verification of:

        1) Server operation and configuration
        2) NOS installation, configuration and operation
        3) HUB insulation and operation
        4) Cable Plant

2. All test equipment shall bear current calibration stickers or dated certificates.

3. Printed test results along with as-built drawings shall be assembled into a 3 ring project binder and delivered to the consultant for verification and final acceptance prior to start of warranty.

3.5 COMMISSIONING

A. General

1. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by owner.
2. Acceptance shall consist of the following:

    a. Burn-in period.

        1) The system shall be accepted for start of warranty upon successful completion and testing of the system.

        2) Burn-in period shall be a 30 day time frame to allow the system to operate free of defects, grounds, programming faults, etcetera.

        3) The 30-day burn-in shall begin the day of acceptance by owner.

4) The burn-in period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.

5) Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner's personnel and correct said deficiencies.

6) Upon correction and restoration, the burn-in period shall be re-set to "0" and the 30 day count shall begin again.

7) Warranty shall commence upon day 31 of successful burn-in period.

b. Final Test

1) Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:

a) The contractor's job foreman, in the presence of a representative of the manufacturer, and a representative of the owner shall operate every network device to ensure proper operation and correct configuration at the file server location.

b) When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner.

c) The contractor shall leave the data network system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the consultant.

B. As Built Drawings, Testing, and Maintenance Instructions

1. A complete set of reproducible as-built drawings in AutoCAD R2014 format (CDs and sheets) showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system acceptance.

2. Operating and Instruction Manuals

a. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the owner upon completion.

b. Provide necessary training and/or schooling to designated owner personnel at no additional cost to owner. Training shall be on site.

C. Testing Frequency Instructions

1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.

2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

a. Instructions on replacing any components of the system, including internal parts.

b. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions

c. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.

d. User operating instructions shall be provided, prominently displayed on a separate sheet located next to the control.

END OF SECTION 16 745

SECTION 16 750 – CABLING AND DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide a complete, tested, Cable Distribution system for Data Processing and Networking systems (local area network), Telecommunications (voice), Audio (paging), Entry Access Control and Monitoring (security) and Closed Circuit Video Surveillance systems (CCTV) as follows:

1. The data distribution system shall include fully terminated fiber optic backbone and CAT-6 STP station cables and specialty data distribution cables and terminations as shown in the contract drawings. All fiber optic trunk cabling will be installed into utility conduit loops around the park in fiber inner-duct. Station cabling will be installed in conduits and office furniture provided by others. This work includes all backbone, horizontal distribution, station cabling and specialty stations/horizontal distribution cabling for the Administration, Point of Sale, Audio, Security, Irrigation and CCTV systems. The contractor shall be responsible to provide and install all cabling, wiring, cabinets, racks, data frames, cable tray, wire management, power distribution, blank panels, structural bracing, inner ducting, termination panels (fiber and UTP), complete testing and certification, along with all as built documentation as set for in these specifications.

2. The voice distribution shall include fully terminated multi pair trunk cablingand CAT-6 STP station cabling along with specialty outdoor cabling and terminations for food carts and retail carts as indicated on the contract drawings. Contractor shall be responsible to provide and install all cabling, wire management, backboards, equipment cabinets, ladder racking, station cabling, specialty cabling, boxes, outlet terminations, splicing (as needed). All voice cabling underground shall use a rated OSP cable. All above ground cabling in conduit may use a CMP rated cable. Conduits and pathways will be installed by others and will be in place prior to the start of wire/cable installation. Complete testing and certification, along with all as built documentation as set for in these specifications.

3. The entry access control and monitoring will utilize a segment of the fiber optic backbone, feeding terminal controllers and I/O boards (FBO) monitoring various security and equipment functions throughout the project. Distribution cabling from controllers and I/O boards are copper cables (coordinate requirements with security contractor) which will provide monitoring to point sensors, motion sensors, equipment, fire protection systems and alarm monitoring. Cabling will be installed into existing underground and above ground conduits. The contractor will be required to provide and install all cabling, terminations, connections, wire management and incidentals for a complete cabled system. Cabling underground shall utilize an OSP rated cable. Cabling above ground shall use a CMP or CL2 or plenum/tray rated cable depending on the application. Complete testing and certification, along with all as built documentation as set for in these specifications.

4. Fiber Optic Riser Cables: Individual 6-fiber, 8-fiber, 12-fiber, 18-fiber, 24-fiber or 48-fiber optical cables shall be installed from the termination enclosure in the new IT Room to fiber

optic termination enclosures in each new DATA IC Communications Closets at each cluster attraction area as shown on the plans.

B. Provide system design services (development of specific details consistent with the contract documents) as required to complete shop drawings for data cable systems including detailed documentation for owner's review and detailed documentation of as-built conditions.

C. Data concentrators, local area network controllers, and data terminal equipment will be furnished by others under separate contract. The contractor shall coordinate with other system vendors where appropriate to facilitate equipment backboard installation, scheduling, protection of equipment, and access to the project site in order to provide owner a complete project in a timely manner.

D. The successful cabling contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by owner prior to the start of work.

E. Raceway Systems Specifications required for voice, data, audio, video systems cables may be found in Electrical Specifications.

F. The successful bidder will not be determined by price alone, but by a rating system to include a combination of price, qualifications, training procedures and proposed documentation package.

G. All unused conduits or interducts shall have metered pull strings.

1.2 DESIGN

A. Floor Plans: Furnish floor plans for review showing outlet locations with an indication of outlet type and proposed label. Floor plans shall be coordinated with architectural and electrical power plans and shall be produced at the same scale as the contract documents (see part 1.4, Submittals).

B. Terminal Elevations: Furnish details showing terminal block and backboard elevations including all cable terminals, spaces for equipment, equipment racks, and station cable routing. Communications equipment closets (intermediate distribution frames - MC) shall be arranged to maximize the utility and growth potential available in spaces shown on the floor plans. Terminal elevations shall be based on detail elevations included in the contract documents and shall show additional detail as indicated herein.

C. Outlet Locations: Provide as shown.

D. Terminal Schedules: Furnish terminal outlet schedules showing terminal block position for all station cabling. Terminal outlet schedules shall show proposed labels for all 4-pair STP horizontal cables at station outlets along with patch or 110 frame locations.

1.3 LOCAL AREA NETWORK (overview, electronics FBO – REFERENCE ONLY)

A. The Local Area Network shall be based on and support IEEE 802.3 functional standards for Ethernet Local Area Networking. This shall include IEEE 802.3 10/100BASE-T for station

microcomputers, and IEEE 802.3 10/100BASE-FX(FIORL) synchronous technology for fiber optic repeater interconnection.

B. The main distribution frame (MDF) and all intermediate distribution frames (IDF's) shall support up to 12 Ethernet segments (Administrative Network, POS, Security, Audio, Irrigation and Lighting).

C. System Switches (FBO) shall be sufficient to support use at full capacity without the need to add Switch chassis. System shall be sufficient to support use at full capacity without user-perceptible delays in network response time.

D. System shall be sufficient to support any combination of system features at full capacity. System shall allow reconfiguration of backbone to allow Customer maximum flexibility and implementation of options in case of need when future services are identified and added.

E. LAN CONFIGURATION

1. Each building or group of buildings supports an IDF that is a switch location. System Switches are required in DESIGNATED locations so that a switch can service every data drop.

2. Each system switch shall allow for growth, without the need to add an additional switch, to 150% of the current data drop count for the area that it serves even though all those drops will not be connected at initial installation.

3. Each designated location shall utilize a system switch as per the specification.

4. Each switch location shall utilize Fiber Optic-Transceiver module for connection to the Fiber Optic backbone (where fiber is utilized as the backbone media).

5. Each switch location shall utilize, 10/100BASE-T (RJ45) shielded twisted pair ports for connection to the UTP Category 5 LAN cable plant. The quantity of initially installed 100BASE-T ports shall be per the needs indicated and requirements of this specification.

6. The initially active 10/100BASE-T locations shall be connected to the system switches via Category 5 STP patch cords and patch panels.

1.4 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to proceed, the Low Voltage Contractor shall furnish the following in a single consolidated submittal:

1. The name of the person who will act as the low voltage Contractor's official contact with the Contractor/Consultant.

2. Electrical Permits. The Contractor shall obtain all required permits and provide copies to Consultant.

3. Complete manufacturer's product literature for all cable, cross-connect blocks, cable supports, cable labels, outlet devices and other products to be used in the installation. In

addition, whenever substitutions for recommended products are made (pre-approved prior to bid by Consultant), samples and the manufacturer's supporting documentation demonstrating compatibility with other related products should be included.

4. A time sealed Construction Schedule using PERT/CPM indicating general project deadlines and specific dates relating to the installation of the cable distribution system. At a minimum, this Construction Schedule shall include the following milestones:

   a. Start of Communications space construction.
   b. Start of Fiber Optic cable terminations.
   c. Start of 4- pair STP and related termination hardware station cable installation.
   d. Start of Level 5e or 6e STP and Fiber Optic backbone cable testing.
   e. Start of Audio Cabling and related termination hardware and testing.
   f. Start of Security and CCTV Cabling and related hardware and testing.
   g. Final inspection.

B. Shop Drawings (within twenty-eight (28) days of notice to proceed).

1.5 SUBMITTALS

A. In addition to the requirements of Division 1, submit all materials for approval arranged in same order as Specifications, individually referenced to Specification paragraph and drawing number. Submit number required in Division 1 plus three (3) copies of 8 1/2” x 11" material and 2 prints plus one reproducible of drawings in 30” x 42” size, minimum. Submit 8 1/2” x 11” items bound in volumes and 30" x 42” drawings in edge-bound sets.

B. Progress Schedule: Include duration and milestones for the following:

1. All submittals specified.
2. Completion of equipment buyout.
3. Completion of equipment receipt at fabrication shop.
4. Shop fabrication.
5. Shop testing.
6. Shipment to site.
7. Installation.
8. Field testing.
9. Training.
10. First event date.

C. Manufacturer's Product Data:

1. List of Materials: For each item, include:

   a. Manufacturer.
   b. Model number.
   c. Listing: UL, City Lab or none.
   d. Quantity.

2. Manufacturer's Product Data: in sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product.

D. Field and Shop Drawings:

1. Resubmit: for coordination reference complete with corrections from previous submittal.

a. List of Materials.
b. Manufacturer's Product Data.

2. Field (installation) Drawings: Collate in sequence:

a. Drawing index/symbol sheet.
b. Floor plans. At scale of Contract Documents. Show:

(1) Devices with circuit number.
(2) Rough-in.
(3) Mounting height.
(4) Conduit size.
(5) Wire type.
(6) Wire fill.

c. Sections/Elevations. At scale of Contract Documents.

(1) Mounting Location Reference

d. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:

(1) Refer to 'floor plans".
(2) Architectural features.
(3) Rack cabinets.
(4) System furniture.
(5) Clearances.

e. System conduit riser drawing, show:

(1) Terminal cabinets.
(2) Coordination with floor plans.
(3) Wire runs not shown on floor plans.
(4) Wire type.
(5) Wire fill.

f. Mounting details

(1) Stamped and signed by consultant licensed in jurisdiction for work of this type.
(2) Show loads, strength of connections, etc.
(3) Show calculations - on drawings or in bound volume for review by authorities having jurisdiction.
(4) Provide details for:

(a) Racks.
(b) Ladder racking
(c) Mounting/attachment

g. Installation details as required.

(1) Terminal cabinets: terminations.

h. Wire run sheets (if used) Show:

(1) Wire Number.
(2) Source.
(3) Designation.
(4) Signal Type.
(5) Wire type.
(6) Operating level or voltage (if applies).

3. Shop (Fabrication) Drawings: Collate in sequence:

a. Drawing Index/symbol sheet (if separate set from Field Drawings).
b. System functional drawings. Submit separate drawing for each system/subsystem. Show:

(1) Equipment: Function, make, model.
(2) Wire number.
(3) Wire Type.
(4) Shield condition at both ends (float, ground, location of ground).
(5) Connector wiring details, each type.
(6) Audio: Polarity, operating level.
(7) Provide drawings for the following systems:

(a) Control.
(b) Audio.
(c) Coordinated grounding scheme.

c. Equipment rack elevations. All racks scaled at one-inch equals one foot (1” = 1’ 0”), or larger. Show:

(1) Power strip: receptacles, circuiting.

d. Rack wiring drawings for, each rack:

(1) Power strip: receptacles, circuiting.
(2) Equipment.
(3) Grounding.
(4) Wiring, all systems.
(5) Wiring harness scheme.

e. Fabrication details submit for:

(1) Receptacles.
(2) Panels.
(3) Special mounting provisions.
(4) Custom enclosures, indicate:

(a) Construction and bracing

(5) Legends/engraving details. Half or full size:

(a) Receptacles.
(b) Panels.
(c) Equipment.

(6) Jackfield, terminations and cross connect details, Front elevation, full size.

(a) Layout.
(b) Text of designations.

E. Samples: Samples for approval by owner

1. Of all finishes/materials which will be visible to the public, including:

a. Receptacles and controls with associated trim plate
b. Each type of information outlet, faceplate, etc.

2. For other items, provide at least two of each as a sample.

F. Shop and Field Test Reports

1. Schedule: Submit test reports in timely manner relative to project schedule such that owner may conduct verification of submitted test data at owner's option, without delay of progress.

a. Shop test report: Submit prior to shipping completed system to project site.
b. Field test report: Submit following system completion and prior to and as condition precedent to owner's acceptance of the work of this section.

2. Test Reports: include:

a. Time and date of test.
b. Personnel conducting test.
c. Test Object.
d. Procedure used.
e. Test equipment, including serial and date of calibration.
f. Results of test - numerical or graphical presentation.

3. Verification of Submitted Test Data: owner may elect to verify some or all test data submitted. Retest in presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this section. Provide all test equipment.

G. Reference Data for Operation, Maintenance and Repair

1. In addition to the requirements of Division 1, submit one (1) additional set.
2. Submit in three post binders (not ring binder) with tabs.
3. Index.
4. Systems operating instructions.
5. Reduced set of system Record Drawings.
6. Key schedule.
7. Maintenance and spare pans schedules.
8. Shop and Field Test Reports.

9. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

H. Record Drawings in AutoCAD R2000 format

1. Quantity:

a. Review sets: as for Shop and Field Drawings.
b. Record set:

(1) Three (3) bluelines.
(2) One (1) mylar.
(3) CD with applicable .dwg files

2. Format: Record Set.

a. Pencil, permanent ink or permanent photographic process.
b. Front face only of Mylar at least 3.0 mils thick.
c. Appliqué film or lettering prohibited.
d. Suitable for microfilming.

3. Content: All drawings required under “Field and Shop Drawings”. Show “as installed” condition.

I. Shop Drawings. The contractor shall submit scaled drawings of all IC/MC backboard layouts showing hardware 110 frame placements prior to new installations. The name of the building, room #, title of room IC/MC, shall be included. The contractor must show dimensions for LAN network equipment backboard space. Coordinate with owner/consultant on any backboard discrepancies.

J. Proposed Contractor Category 5e or 6e STP, and fiber optic cable test result forms.

K. As a condition for project acceptance, the contractor shall submit the following for review and approval:

1. Complete manufacturer’s product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.

2. An exceptions list of deviations (in materials, construction and workmanship) from those specified in this section and shown on the Project Drawings. Owner will review this list and declare each item as either an approved exception, or as one the contractor must correct.

3. Inspection and Test Reports: During the course of the project the contractor shall maintain an adequate inspection system and shall perform such inspections to insure that the materials supplied and the work performed conform to contract requirements. The contractor shall provide written documentation, which indicates materials acceptance testing was conducted as outlined in Part 3 below. The contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion for owner/consultant analysis.

1.6 SYSTEM INSTALLATION REQUIREMENTS

A. System installer must have a BICSI RCDD on staff. Copy of certification must be submitted at time of bid.

B. The data cable system installer shall be a firm normally employed in the low voltage cabling industry with a reference list of five (5) projects and contact names to confirm successful Category 5e or 6e STP and Fiber Optic cable plant projects.

C. Owner reserves the right to exercise its discretion to require the Contractor to remove from the project any such employee of owner's to be deemed incompetent, careless or insubordinate.

D. A fifteen (15) year manufacturer warranty shall be provided by the selected low voltage installer. This warranty shall include defects in material and workmanship. The warranty period shall begin at the date of owner's acceptance of the work. Quality and workmanship evaluation shall be made solely by owner/consultant and designated representatives.

E. The selected low voltage installer must be licensed and bonded.

F. All clean up activity related to work performed will be the responsibility of the Low Voltage Communication Contractor and must be completed daily before leaving the facility.

1.7 REGULATORY REQUIREMENTS

A. All work shall be performed in accordance with the latest revisions of the following standards and codes:

1. Uniform International Conference of Building Officials
2. Building Code (ICBO); Regional Office
3. BICSI

B. Other References:

1. TIA/EIA- 569 Commercial Building Standard for Telecommunication
2. Pathways and Spaces.
3. TIA/EIA-568-A Commercial Building Wiring Standard
4. EIA-455-171-D Standard Test Procedures for Fiber Optic Cables
5. TIA/EIA-4750000-B Generic Specification for Fiber Optic Connectors
6. TIA/EIA-475E000 Sectional Specification for Fiber Optic Connectors Type
7. BFOC/2.5
8. TIA/EIA-604-X Fiber Optic Connector Intermateability Standards (FOCIS)
9. Leviton Telcom Category Compliant Design Criteria dated 1995 or Later
10. Leviton Telcom CCS Installation Training dated 1995 or later

C. Governing Codes and Conflicts: If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall be construed to permit work not conforming with all governing codes and regulations.

1.8 ABBREVIATIONS and DEFINITIONS

A. MC - Main Cross-connect often co-located in the building Entrance Facility (E) and/or Equipment Room (ER) and consisting of riser cable terminals, utility service cable terminals, PBX terminals, and various other equipment.

B. IC - Intermediate Cross-connect usually residing in a Telecommunications

C. Closet (TC) and consisting of station wire terminals, riser cable terminals, and various equipment. Used to connect the first and second level backbone cables in a two-tier star wiring topology.

D. HC - Horizontal Cross-connect usually residing in a telecommunications closet and consisting of station wire terminals, riser cable terminals, and various equipment. Used to connect the first or second level backbone cables to the horizontal or work area cables.

E. PBX - Private Branch Exchange, a telephone switch.

F. PDS - Premises Distribution System, a common term used for the cable, terminals, and miscellaneous equipment comprising telephone and data transmission systems.

G. STP - Shielded Twisted Pair (telecommunications/data station cables)

PART 2 - PRODUCTS

2.1 GENERAL WIRING

A. The inside/outside wiring plant shall be installed per requirements of these specifications utilizing materials meeting all applicable TIA/EIA standards.

B. Materials shall be as listed or shall be equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA568 specification. In some cases specific materials are called out to maintain a uniformity of application across all installations. The Contractor shall maintain the same material uniformity for all buildings.

C. All installed wire shall be tested and labeled 100% good after installation by the installer.

D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

1. Communications Cable.
2. Plenum rated Communications Cable.
3. Riser rated Communications Cable.

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket, which would indicate possible

problems. Damaged cable, or any other components failing to meet specifications shall not be used in the installation.

F. Quantity: Provide quantity as shown on Contract Drawings, the Schedule or as otherwise defined herein.

G. Preference: Owner desires system to be furnished and installed as specified herein.

H. Substitutions: Comply with GENERAL CONDITIONS.

I. Provide Complete: Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section at, if specified in full herein.

J. Provide New: All materials provided under the Work of this Section shall be new, shall be the manufacturer's latest design / model, and shall be permanently labeled with the manufacturer's name, model number and serial number.

K. Similar: Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

L. Continuous Use: All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

M. CABLE PLANT REQUIREMENTS

1. The cable plant shall be a star configured, unshielded twisted pair system capable of supporting data rates of 1Ghz.

2. The drop cable shall run from intermediate wiring closets (IDF's) to each office, work station, attraction, food service and retail location as well as other miscellaneous locations as shown on the prints.

3. The trunk fiber optic cable shall run between the main distribution frame (MDF) and each switch (IDF) location as indicated on the project drawings.

4. The cable plant shall meet EIA/TIA-568 "Commercial Building Telecommunications Wiring Standard" and the maximum length of any STP data drop shall NOT exceed 100 meters including patch cables and future jumper cables at each information outlet location.

5. Every switch location shall have one 24 strand multi-mode/single (12mm, 12sm) mode hybrid fiber optic cable (dedicated) from the MDF for LAN service, UON.

N. CABLE PLANT SUPPLIERS

1. The wire provided for all voice trunk runs shall be UTP Category 5e cable UON (OSP rated for below grade use)

a. Recommended suppliers: Berk-Tek, Essex, Belden, Lucent, Avaya.

2. The wire provided for all data and voice outlets shall be one four pair STP Category 5e or 6e cable per jack, UON (OSP rated for below grade use).

    a. Recommended suppliers: Berk-Tek, Essex, Belden, Lucent

3. The wire provided for all security monitoring sensors shall be 2 pair #22 for point sensors and 4 pair #22 plus 1 pair #20 for powered motion sensors.

    a. Recommended suppliers: West Penn, Belden, Atlas, Mohawk

4. The wire provided for all security camera locations shall be RG58/U coaxial cable with 100% shield or fiber optic cabling. power cabling for cameras shall be #18 Ga. min. cabled constriction. All cabling below grade shall be rated for the application.

    a. Recommended suppliers: West Penn, Belden, Atlas, Mohawk

2.2 CABLING SPECIFICATION

A. STATION WIRING-DATA

1. The wire provided for all data outlets shall be one 4-pair STP Category 5e cable per jack, UON.

    a. The Category 5e or 6e, 4-pair UTP cable, must be Performance Level Tested. Each 1000' spool must be individually tested with test results affixed.

B. DROP CABLE SPECIFICATION

1. All data drop cabling shall be EIA/TIA 568, 569 and TSB-36 Category 6 certified.

2. All data drop cabling shall be 4-pair shielded twisted pair, PVC rated (OSP rated for underground use), Category 6e certified cable. Untwisted cable shall not be used. This includes even short pieces of flat cable for jumpers, etc.

3. All data drop cabling shall also be guaranteed by the cable manufacturer to support data rates to 1Ghz. The bidder must include in writing in the form of press release, newsletter, or cut sheet verification of cable capabilities.

C. STATION WIRING- VOICE

1. The wire provided for all voice outlets shall be one 4-pair STP Category 6e cable per jack, UON.

    a. The Category 6e, 4-pair UTP cable, must be Performance Level Tested. Each 1000' spool must be individually tested with test results affixed.

2. DROP CABLE SPECIFICATION

    a. All voice drop cabling shall be EIA/TIA 568, 569 and TSB-36 Category 6e certified.

b. All voice drop cabling shall be 4-pair shielded twisted pair, PVC rated (OSP rated for underground use), Category 6e certified cable. Untwisted cable shall not be used. This includes even short pieces of flat cable for jumpers, etc.

c. All voice drop cabling shall be 24 AWG shielded twisted pair cable. All cabling for a single copper conductor shall have a maximum DC resistance of 28.6 ohms per 1000 feet at 20 degrees Celsius. All cabling shall have a maximum DC resistance unbalanced of 5 percent. All cabling will have a maximum mutual capacitance of a pair of 17 picofarads per foot. All cabling shall have a maximum pair-to-ground capacitance unbalanced of 1000 picofarads per 1000 feet.

d. All voice drop cabling shall have an impedance (ohms) of the following values:

0.064	125±15%
0.128	115±15%
0.256	110±15%
722 kHz	102 + 15%
1.0-100.0 MHz	100 + 15%

e. All voice drop cabling shall have a maximum attenuation (dB per 1000 feet at 20 degrees Celsius) of the following values:

1.0 MHz	2.0
4.0 MHz	4.1
8.0 MHz	5.8
10.0 MHz	6.5
16.0 MHz	8.2
20.0 MHz	9.3
25.0 MHz	10.4
31.25 MHz	11.7
62.5 MHz	17.0
100.0 MHz	22.0
155.0 MHz	28.1
200.0 MHz	32.4
310.0 MHz	41.8
350.0 MHz	44.9

f. All voice drop cabling shall have a minimum Near-End Crosstalk coupling loss for any pair combination at 20 degrees Celsius shall be greater than the value determined by using the following formula for all frequencies in the range of:

0.772 MHz to 100MHz for a length of 1000 feet:
NEXT (F) > NEXT (0.772) - 15 log (F/O.772)

g. All voice drop cabling shall also be guaranteed by the cable manufacturer to support data rates to 350Mhz. The bidder must include in writing in the form of press release, newsletter, or cut sheet verification of cable capabilities.

h. Provide components consistent with the quality of KRONE part number TN5ETR-BLRB (blue) or approved equal, UL Subject 444, (UL)-C(UL) Type MPR/CMR/CMG, ICEA S-90-661, NEC 800 Type CMR TIA/EIA-568-A Cat 5 Horizontal Cable

Requirements, ISO/IEC 11801 Category 5, TIA/EIA-568-A-5 Cat 5e Enhanced Horizontal Cable Requirements certified.

2.3 STATION HARDWARE-DATA

A. Flush mount jacks shall be high quality Category 6e, 8-position modular jack with twisted lead-frame construction and 110 style terminations terminated with a high impact 110 termination tool. Jacks shall provide dual color code to allow both T568A and T568B wiring on the same jack, and shall provide a cutting ledge to automatically trim wires during termination. Jacks shall meet TIA/EIA-568-A requirements for Category 6e connecting hardware as manufactured by KRONE or Avaya.

B. Faceplates shall match manufacturer for 8-position modular jack outlets at all locations.

C. All data connecting hardware shall be EIA/TIA TSB-40 Category 6e certified.

D. All data connecting hardware shall be modular jack panels with RJ45 jacks on the front and 110 style insulation displacement connectors (IDC) for termination of drop cable on the back.

E. All modular jacks shall be eight position jacks with pin/pair assignments utilizing EIA/TIA T568B.

F. All modular jacks shall be made continuous to the B-pin modular jack via a printed wiring board interconnection.

G. The connecting blocks shall be KRONE IDC style or approved equal.

H. The outlets faceplates shall be KRONE or approved equal in 4-6-8 port configurations. Supply 1 - 8 conductor modular data jacks and cables as a minimum per location.

2.4 STATION HARDWARE-VOICE

A. Flush mount jacks shall be high quality Category 6e, 8-position modular jack with twisted leadframe construction and 110 style terminations terminated with a high impact 110 termination tool. Jacks shall provide dual color code to allow both T568A and T568B wiring on the same jack, and shall provide a cutting ledge to automatically trim wires during termination. Jacks shall meet TIA/EIA-568-A requirements for Category 6e connecting hardware as manufactured by KRONE.

B. Faceplates shall match manufacturer for 8-position modular jack outlets at all locations.

C. All voice connecting hardware shall be EIA/TIA TSB-40 Category 6e certified.

D. All wiring voice connecting hardware shall be modular jack panels with RJ45 jacks on the front and 110 style insulation displacement connectors (IDC) for termination of drop cable on the back.

E. All modular jacks shall be eight position jacks with pin/pair assignments utilizing EIA/TIA T568B.

F. All modular jacks shall have a maximum attenuation corresponding with the table below. They shall approximate value of an equivalent of a 2 meter cable of the same category or any pair within a connector of the following values:

1.0Mhz	0.1
4.0	0.1
8.0	0.1
10.0	0.1
16	0.2
20	0.2
25	0.2
31.25	0.2
62.5	0.3
100	0.4

G. All modular jacks shall have a maximum NEXT corresponding with the table below:

1.0Mhz	>65
4.0	>65
8.0	62
10.0	60
16	56
20	54
25	52
31.25	50
62.5	44
100	40

H. The connecting blocks shall be KRONE IDC style or approved equal.

I. The outlets faceplates shall be KRONE or approved equal in 4-6-8 port configurations. Supply 1 - 8 conductor modular data jacks and cables as a minimum per location.

2.5 MC(MDF) /IC (IDF) /HC STATIoN TERMINATION HARDWARE-data & VOICE

A. Patch Panels

1. Category 6e STP Termination Hardware. The Category 5e data station cable shall be terminated on Category 5e STP, 8-position modular jack patchpanels with circuit board construction in all IC/MC locations. The panels will have rolled upper and lower edges for rigidity and will provide front and rear side labeling visible after the cables and cords are installed. The 8-position modular jack patch panels shall be either wall mounted or rack mounted with cable management panels per communication detail sheets. The contractor is responsible for all wall brackets, patch panels, and cable management panels for all IC/MC/HC layouts and equipment rack configurations.
2. Products: Category 5e STP patch panels (T568B wired, TIA/EIA-568).
3. Cable management brackets must be provided at each rear section of the patch panel to facilitate cable routing and maintain proper bend radius of cables leading to the termination point.

    a. Recommended Product: Krone

4. Cord or Patch Cable Manager: The cord manager shall have five (5) rings and provide the capability to organize and contain up to forty-eight (48) patch cords on the front of the panel. The front of the panel shall provide five (5) high capacity 1.5" x 4" horizontal distribution rings to reduce stress on stored cables to retain optimal cable geometry. All distribution rings shall have radiused edges to protect cables from nicks and tears. The cable manager shall be a minimum of two (2) RU high, and shall fit a standard 19" EIA rack rails.
5. Provide patch panels as required to terminate all indicated station outlets as shown on the project drawings.
6. Patch panels shall be provided at all EER locations indicated.
7. Supply patch panels in rack mount versions with a minimum of 24-32\ports.
8. The patch panels shall exhibit the following minimum characteristics:

    a. EIA 19” rack mountable
    b. 110 rear termination
    c. Modular jacks are circuit board mounted
    d. supports 568A and 568 wiring
    e. removable front labels
    f. requires 3.0” rack space. min.

9. The patch panel shall meet TSB-40 standards.
10. Supply patch panel with full compliment of CAT-6e data patch cables. CAT-6e patch cables shall be configured as follows:

    a. Color: Yellow
    b. 24,36,48,60 & 72” in length
    c. RJ45 each end with strain relief boots
    d. stranded copper wire

11. Acceptable vendors for patch panels which are pre-approved for this project are:

    a. KRONE

2.6 MC(MDF) /IC (IDF) /HC TERMINATION HARDWARE-VOICE TRUNK CABLING

A. Main Cross Connect Base

1. The cross-connect shall provide Category 5e compliant 110 termination capable of supporting voice, security, and Category 5e data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to walls or backboards in a mounting-frame style unit, which provides additional cable access and horizontal cord management. The units shall be UL listed, CSA certified, TIA/EIA-568-A and Category 5e compliant, and made in the USA. The mounting frames shall support up to three 100-pair wiring bases, with the capability to accept extension units to create higher densities of up to 900 pairs per tower. The mounting frames shall be made of 16 gauge steel; wiring bases and blocks shall be made of fire-retardant plastic rated UL 94V-0, with provision for TIA/EIA-606 compliant labeling. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and

workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

B. Main Cross Connect Extension

1. The cross-connect shall provide Category 5e compliant 110 termination capable of supporting voice, security, and Category 5e data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to walls or backboards in a mounting-frame style unit, which provides additional cable access and horizontal cord management. The units shall be UL listed, CSA certified, TIA/EIA-568-A and Category 5e compliant, and made in the USA. The mounting frames shall support up to three 100-pair wiring bases, with the capability to accept extension units to create higher densities of up to 900 pairs per tower. The mounting frames shall be made of 16 gauge steel; wiring bases and blocks shall be made of fire-retardant plastic rated UL 94V-0, with provision for TIA/EIA-606 compliant labeling. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

C. 100 Pair IDC 110 Terminations

1. The cross-connect shall provide Category 5e compliant 110 termination capable of supporting voice, security, and Category 5e data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to 19” distribution frame or hinged wall mount bracket. They shall be UL listed, CSA certified, TIA/EIA-568-A and Category 5e compliant, and made in the USA. Panels shall support 100, 200 or 300 pair densities with provision for TIA/EIA-606 compliant labeling, and be made of 16 gauge steel, with bases and blocks made of fire-retardant plastic rated UL 94V-0. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

D. Horizontal Cord Manager

1. The horizontal 110 cord managers shall mount to a wall or backboard, or onto 300 pair mounting-frame basic or extension units, providing the capability to organize and contain patch cords between rack mount 110 wiring bases. The cord managers shall comply with TIA/EIA-568-A and -606 requirements, and be made of fire-retardant plastic rated UL 94V-0. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

E. 110 Connector Blocks

1. The 110 connector blocks shall support termination for voice, security, and Category 5 data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The blocks shall be Category 5 compliant, UL listed, CSA certified, and TIA/EIA-568-A compliant. They shall be made of fire-retardant UL 94V 0

plastic with solder-plated insulation displacement connectors, and must securely seat wires on 110 wiring bases, providing a gas-tight IDC connection that can withstand 200 reterminations. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

F. 110 Patch Cords and Plug Assemblies

1. Provide 110 Patch Cord and Plug Assemblies and patching cables as needed to cross connect all cabled stations/ports in system. Supply compliment of various length cables to cross connect as required.
2. Provide spares as follows:

a. 10 - 36”
b. 10 - 48”
c. 10 - 60”
d. 10 - 72”
e. 10 - 84”

2.7 DATA DISTRIBUTION EQUIPMENT RACK

A. Provide equipment racks and/or frames in locations indicated on the drawings. Racks shall be equipped as detailed on the drawings and as hereafter specified.

B. MC/IC/HC locations provide IMRAK 7' tall equipment racks (or as indicated), or equivalent.

C. FREE STANDING CABINETS:

1. Provide 19” or 24” EIA floor mount cabinets with bracing brackets and floor mounting accessories as required to support cabling infrastructure with 19” EIA patch panels, data switches and light interface guides along with ancillary equipment.

2. Provide IMRAK 1400 or ZERO XA series as manufactured by VERO ELECTRONICS or pre-approved equal.

3. The cabinet shall incorporate a Plexiglas, locking front door assembly and solid rear door with lock.

4. Provide with required horizontal and vertical cable management for all racks/cabinets, panels and hardware as required to facilitate complete installation.

D. Jumper Management Panels

1. The rack mount hardware shall incorporate in-rack and interbay jumper management techniques. One or both methods may be used as required. In-rack management panels shall be available to provide jumper storage and routing to the connector housings and electronic switches. Additionally, in-rack panels are required for installations where interbay storage methods are not feasible (i.e. already installed lineup where footprints are

already specified). Interbay storage is recommended for large slack storage requirements and multiple out of bay patching.

2. In-Rack jumper management panels shall be available in 1-RMS, 2-RMS and 3-RMS sizes and shall have removable front covers to conceal and protect the jumpers when installation is complete. The front of the jumper management panel cover shall be flush with the front door of the connector housing.

3. Jumper management panels shall be designed to maintain a 1.5 inch minimum bend radius when transitioning between routing panels and frame verticals or connector housings and shall be finished with a wrinkled black powder coat for durability. All fasteners shall be black chromated to match the housing.

4. The vertical jumper routing area shall have vertically adjustable cable retaining rings. The adjustable routing rings shall include a swing out door for ease in jumper routing. The sides of the adjustable routing rings shall have radius guides to provide minimum bend radius control. The rear side of the vertical routing area shall also provide cable retaining rings that hold data and power cables close to the rack to eliminate accidental snags from maintenance personnel.

5. Slack storage spools shall be provided when jumper slack storage is required in-rack.

6. Slack storage shall be available using both in frame and interbay storage panels. The storage panels shall be functional both individually and combined.

7. The Interbay Storage panel shall provide both front and rear jumper routing distribution and storage. The interbay storage panel shall be designed to integrate with an EIA standard 7 foot tall equipment rack. The interbay panel shall have a footprint of 6 inches in width and shall have a removable cover that is flush with the front doors of the connector housings when installed. The panel shall be finished with a wrinkled black powder coat for durability. All fasteners shall be black chromated to match the housings.

8. Wall-mountable hardware shall have a means to transition between the connector housing and cable trough or tray.

E. Distribution Rack Grounding: Provide grounding kit similar to IBM Part # 4716804 for each IC and MC. Rack shall be grounded using stranded # 6 AWG insulated copper conductor. Provide all required bonding material and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

2.8 UNDERGROUND VOICE TRUNK CABLING

A. GENERAL

1. Underground voice trunk cabling shall be installed as indicated on the contract drawings and as called for in these specifications.
2. All UTP voice trunk cabling shall be installed in underground conduit and manhole infrastructure without splicing.
3. The trunk cabling shall be installed free of defects and in accordance with AT&T outside plant installation manuals.

4. The cabling shall exhibit the following properties:

   a. 6,12,25,50,100,200 pair configurations
   b. PIC ALPETH Filled FOAM SKIN “DEPIC”
   c. RE-89 Listed
   d. FlexGel filling compound
   e. Electrical properties:

      (1) Mutual Capacitance - nF per mile = 83 +/-4
      (2) Unbalanced Capacitance - pF per 1000’ = 100
      (3) Pair to Ground Capacitance - pF per 1000’ = 800
      (4) DC Conductor Resistance - ohms per 1000’ = 27.5
      (5) Resistance Unbalance - 1.5 ohms
      (6) Min. Dielectric Strength (kV) = 3.0
      (7) Insulation Resistance - megohm per mile = 10,000
      (8) Nominal Attenuation - dB per mile = 13.4
      (9) Far End Crosstalk - dB per 1000’ = 73
      (10) Near End Crosstalk - dB per 1000’ – 66

2.9 FIBER OPTIC CABLE SPECIFICATIONS

A. BACKBONE CABLING FIBER OPTIC CABLE PLANT

1. Outdoor Tight Buffered Hybrid Fiber Optic Cable

   a. Outdoor Cable is designed for backbone interbuilding (outside plant) applications. The cable shall be designed for use outdoors and provide excellent protection from the elements.

   b. The cable shall meet the requirements of the National Electrical Code, Article 770, TIA/EIA 568A “Commercial Building Telecommunications Wiring Standard”, ICEA-83-596-1988 Insulated Cable Engineers Association Standard for Fiber Optic Premises Distribution Cable Publication S-83-596, December 1988, ANSI X3.166-1990 Fiber Data Distributed Interface (FDDI), Token Ring Physical Layer Medium Dependent (PMD), and a combination of Bellcore Generic Requirements for Optical Fiber and Fiber Optic Cable (GR-20-CORE)

   c. A tight buffered construction shall be used. The cable shall be constructed Core Locked indoor/outdoor PVC out jacket. The fillers, if used, shall be combined and covered with a medium density jacket to provide excellent environmental protection.

2. Multimode Fibers (24 per cable)

   a. Multimode fibers in the cable shall contain 50 micron graded index multimode fibers. These fibers are located inside the buffer tubes. Multimode fibers shall meet the specifications defined by the Multimode Optical Fiber Specifications.
   b. Fiber Identification

      (1) The fibers within each buffer tube shall be distinguishable from each other by means of color coding. The color coding sequence shall be blue, orange, green, brown, slate, white, red, black, yellow, violet, rose and aqua.

c. Stranding member using a reverse oscillating lay (SZ) stranding method with counter helically applied non-hydroscopic binder tapes.

3. Single Mode Fibers (12 per cable)

a. Single Mode Fibers in the cable shall contain 9 micron graded index multimode fibers. These fibers are located inside the buffer tubes. Single mode fibers shall meet the specifications defined by the Single Mode Optical Fiber Specifications.

b. Fiber Identification

(1) The fibers within each buffer tube shall be distinguishable from each other by means of color coding. The color coding sequence shall be blue, orange, green, brown, slate, white, red, black, yellow, violet, rose and aqua.

c. Stranding member using a reverse oscillating lay (SZ) stranding method with counter helically applied non-hydroscopic binder tapes.

4. Strength Member

a. The primary strength member shall consist of aramid yarns applied around the fibers.

5. Cable Jacket

a. A black jacket made of medium density polyethylene (MDPE) shall be extruded around the cable core and aramid yarn. The jacket shall have two co-extruded tracer stripes located 180° apart for identification. The tracers shall be MDPE jacket material.

b. The cable jacket shall be designed for easy removal, with readily available tools. The design shall permit jacket removal without damage to the optical fibers.

c. The cable jacket shall be printed with manufacturer name, sequential length marking, the number and type of fiber and the appropriate cable type marking according to NEC Section 770.

6. Minimum Bend Radius

a. The minimum static bend radius shall be 10 times the cable outside diameter. The minimum dynamic bend radius shall be 20 times the cable outside diameter.

b. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.

7. Impact Resistance

a. The average increase in attenuation shall not be greater than specified by GR-20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.

b. Testing shall be done in accordance with EIA-455-25A (Impact Testing of Fiber Optic Cables and Cable Assemblies). Optical Attenuation chances shall be measured following the procedures of EIA-455-20 (Measurement of Change in Optical Transmittance). The cable specimen shall be subjected to 25 impacts of 4.3 N.M.

8. Compressive Strength

a. A representative sample of the cable shall withstand a minimum compressive load of 440 N/mm (250 lbf/in) for armored cable, and 220 N/cm (125 lbf/in) for nonarmored cable applied uniformly over the length to the compression plate.

b. The average increase in attenuation shall not be greater than specified by GR- 20-CORE depending on the type of fiber used, single-mode or multimode.

c. Testing shall be done in accordance with EIA-455-41 (Compressive Loading Resistance of Fiber Optic Cable).

9. Tensile Strength

a. The average increase in attenuation at the rated tensile load of the cable shall not exceed than specified by GR-20-CORE depending on the type of fiber used, single-mode or multimode.

b. The maximum dynamic (short term) tensile load rating will be 600 lbs. (2700 Newton's). The maximum static (long term) tensile load rating shall be 135 lbs. (600 Newton's).

c. Testing shall be done in accordance with EIA-455-33A (Fiber Optic Cable Tensile Loading and Bending Test).

10. Cable Twist

a. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.

b. Testing shall be done in accordance with EIA-455-85 (Fiber Optic Cable Twist Test). The test length (L) shall be a maximum of 4 meters.

11. Cable Cycling Flexing

a. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.

b. Testing shall be performed in accordance with EIA-455-104 (Fiber Optic Cable Cyclic Test). The cable shall be flexed for 25 cycles at 30 cycles/minute.

12. Outer Jacket Yield Strength

a. The yield strength and ultimate elongation of the outer cable jacket shall be tested in accordance with EIA-455-89A (Fiber Optic Cable Jacket Elongation and Tensile Strength).

13. Jacket Shrinkage

a. The maximum cable jacket shrink back shall be less than 5%.
b. Testing shall be done in accordance with EIA-455-86 (Fiber Optic Cable Jacket Shrinkage).

14. Temperature

a. The cable shall maintain optical and mechanical integrity over the following temperature ranges:

(1) Operation:-40° C to +85° C
(2) Installation-40° C to +70° C
(3) Storage:-40° C to +75° C

15. Cable Reels

a. The cable shall be shipped on non-returnable wooden reels designed to prevent damage to the cable during shipment and installation. Wooden lagging boards will be fastened across the reel flanges.

b. Each reel should be clearly marked to indicate the direction in which it should be unrolled to prevent loosening of the cable on the reel.

16. Reel Covering

a. A covering shall be placed between the flanges over the exposed cable. The covering shall be weather resistance and shall limit solar heating of the cable.

b. The cable ends shall be securely fastened. The end attachments shall prevent the escape of any filling compound and shall prevent the entry of moisture.

17. Reel Identification

a. Each reel of cable shall be stenciled or have a data sheet attached (Packaged in a waterproof wrapping) containing the following information:

(1) Reel identification number
(2) Measured attenuation of cable
(3) Length of Cable

18. Quality Control

a. Each master reel shall be tested to ensure fiber integrity, attenuation, and cable length. Multimode fibers shall be tested at both 850 and 1300 NM. Single mode fibers shall be tested at both 1300 and 550 NM. Each master reel will be given a unique identification and the test results documented. The manufacturer shall

maintain documentation such that the cable history may be traced to the individual fibers used in construction of the cable.

19. Test Report

    a. A test report shall be included with each reel of cable. This test report will include the cable description, unique reel identification, measured length of the cable in meters and feet, attenuation measurements at wavelengths tested and the manufacturer name and address.

20. Provide components consistent with the quality of Optical Cable Corporation DX Series certified.

2.10 FIBER OPTIC CABLE TERMINATIONS

A. Fiber Optic Cable shall be installed in innerduct. Outside gel filled fiber cable shall be installed in conduit or UL approved plenum innerduct. Non-riser rated gel filled cable must be terminated within 50' of building entrance per BICSI Standards.

B. Terminations shall be performed by a manufacturer trained and certified technician for optical fiber connections.

C. Fiber Optic connectors shall be:

1. SC connectors for all single mode terminations.
2. ST connectors for all multimode terminations.

D. Fiber Optic couplings shall be as provided by on in fiber patch panels and shall be either multi-mode or single mode ST as required for the application.

E. Terminations shall be made in a controlled environment. The contractor may choose to have the cables assembled off-site, although testing must be completed with the cable in its final installed condition.

2.11 DATA-MC/DATA-IC/DATA-HC FIBER OPTIC CABLE TERMINATIONS

A. Optical Fiber Connectors.

1. Products: 3M Corporation, AMP or Lucent ST connectors.
2. Optical Fiber Termination Enclosures used in the DATA-MC/DATA- IC/DATA-HC rooms shall provide termination panels for ST or SC type connectors and be of sufficient size and capacity to terminate 100% of the fiber count of the inside or outside fiber optic cables. Patch panels must be wall or 19" rack mountable depending on IC/MC/HC applications. Provide all termination accessories, enclosures, and testing for a complete fiber optic distribution system.

    a. Products: KRONE 36 port panels

B. Optical Fiber Patch Panels

1. The patch panel shall provide 36 fiber couplings in 3.0" of vertical rack space. These couplings shall be pre-installed in a single bulkhead. The patch panel shall have removable front and rear doors as well as a removable lid. There shall be vertical and horizontal ingress/egress features in the form of slots in the top, bottom and sides of the panel, both front and rear. All ingress/egress slots shall be covered with a self-adhesive UL 94V-0 rated grommet material. All ingress/egress slots shall have a strain relief post with a slot capable of holding a tie wrap. The panel shall provide strain relief in the form of a grounding lug and multiple tie-wrap points. The panel must have mounting ears that allow mounting on 19" or 23" hole centers in either a mid- or flush-mount configuration. The panel shall have dual, adjustable plastic cable management rings made of high impact UL 94V-0 rated self-extinguishing plastic. The patch panel shall be capable of having a slide feature attached to it to allow the entire box to be moved in and out of the rack. A port identification label/card shall be provided. The panel shall be made of 16 gauge steel, painted black. A one-year limited warranty shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.
2. Approved Supplier: KRONE

PART 3 – EXECUTION

3.1 GENERAL

A. The contractor shall avoid penetration of fire-rated walls. Sleeving shall be installed for access where necessary.

B. Any penetration through fire rated walls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant. Use 3M Firestop material. Contractor shall also seal all floor, ceiling, and wall penetrations in fire or smoke barriers and in the MC, IC's and wiring closets.

C. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

1. Recommended Products:

a. Twisted-pair cable: Dyna-Blue, American Polywater.
b. Optical fiber cable: Optic-Lube, Ideal

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 lbs.

E. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

F. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over twisted pairs at terminals, and sheath removed too far (over 2").

G. All cable shall be continuous and splice-free for the entire length of run between designated MDF, IDF, pull boxes or terminations.

H. Terminate all cable in designated MDF,IDF,Jacks and/or designated equipment backboards. No terminations or splices shall be permitted in pull boxes, underground or any non-designated termination point.

I. Provide service loop of cables at all junction and termination cabinets or boxes and backboards.

J. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system.

K. Provide identification labels on each cable ends, backboard, wall jack and installation log in accordance with EIA/TIA 606. Cable labels shall be imprinted or type written style and shall be attached in a manner as to allow easy viewing along the length of the wire/cable. Acceptable systems are PANDUIT, BURNDY or approved equal. Submit to Consultant for approval of method.

L. Provide installation logs supporting building infrastructure.

M. Dress or harness all wire and cable to prevent mechanical stress of electrical connectors. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

N. Configure and cross connect all ports as required for complete end to end system.

O. Strap or secure cables every 5 feet. Do not strap to lighting, ceiling grid, etc.

P. Cables shall be routed in corridors whenever possible to avoid unencumbered access to cables.

Q. Cables shall be placed as a minimum of 12” from 208-240VAC power and 18” from 480 power.

R. Maintain 18” clearance between light fixtures incorporating ballast operation.

S. Cables shall be installed to preclude damage and not come in contact with sharp edges of building, wireways or casework/furniture.

T. Maintain minimum bend radius per drawing details.

U. Cables shall be a minimum of 30” from heating, steam valves etc.

V. All conduits shall have bushings in place prior to cable installation.

W. All installation shall be coordinated with Consultant for Milestone verification.

3.2 LABELS

A. The labeling plan shall be developed by the Contractor and approved by owner.The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels approved by owner. Terminals in the HC's/IC's/MC's shall be labeled

by the contractor using designation strips designed for 110 hardware or as applicable to terminal hardware. All copper/fiber terminal for riser cables in the HC and/or IC shall correspond to terminal numbering in the MC.

B. The labels on HC/IC station terminal blocks shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal block position. Labels shall include a room number component and a sequential extension. The room number component shall reflect the numbering system utilized for existing door labels or room numbers as selected by owner. For example, the third outlet in room 25 (starting on the left side of the door and working clockwise around the room) is labeled: "25.3."

C. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

D. All labels shall correspond to as-built and to final test reports.

3.3 STATION WIRING INSTALLATION

A. The low voltage Contractor's RCDD shall supervise the installation of communications cable. All Category 5e and Fiber Optic cable shall be installed by individuals trained in low voltage data cable system installation. All Category 5e (4) pair STP cable must be handled with care during installation so as not to change performance specifications. The Contractor shall not over-tighten tie wraps or over-bend the Category 5e STP cable.

B. Exposed station wire will only be run with owner approval. Approval will be granted only when no other option exists. When station wire must be run surface to a single outlet, surface raceway shall be used to cover the cable.

C. All wiring and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All wiring and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing). All wiring, and associated support structures and hardware shall be placed so as not to impair owner's efficient use of their full capacity.

D. All wiring placed in ceiling areas must be tied or clamped. When wire is placed in ceiling areas or other non-exposed areas, fasteners shall be placed at intervals no greater than 60" and preferably on 48" centers. Cable sag between supports shall not exceed 12". Attaching wire to pipes or other mechanical items is not permitted. At all runs of twenty or more cables, provide rings at 60" (maximum) centers to hang cable. Communications cable shall be routed to avoid light fixtures (18" minimum spacing), sources of heat (12" minimum spacing) and power feeder conduits (12" minimum spacing). Communications cabling must be spaced a minimum of 120" (10') from bus duct.

3.4 STATION HARDWARE

A. Eight (8)-position modular jack pin assignments:

B. Pin connections for data station 8-position modular jacks and patch panels shall match TIA/EIA-568-A modular jack recommendation T568B that is both 10/100BaseT compatible.

C. Pin connections at data jack panels shall match pin connections at outlets with straight through wiring.

D. Terminations at telephone terminal blocks (where required to maintain existing station cable) shall match following pair sequence for T568B:

1. Pair 1, Pins 5 and 4, White-Blue, Blue (/White).
2. Pair 2, Pins 1 and 2, White-Orange, Orange (/White).
3. Pair 3, Pins 3 and 6, White-Green, Green (/White).
4. Pair 4, Pins 7 and 8, White-Brown, Brown (/White).

3.5 BACKBOARD CABLING/EQUIPMENT RACK CONFIGURATION

A. Cable installation in the Entrance Room and Communications Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment mounting access hatches to air filters, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings. Provide a minimum of 36" for a service loop to the patch panel.

B. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or tie-clamp all similarly routed cables together, and attach by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

D. Do not over-tighten cable ties or binding on Category 5e station cable. Observe Category 5e cable bend radius.

3.6 PROTECTION OF WORK SPACE AND AREA - SITE SAFETY

A. SIGNS, BARRICADES, MARKING TAPE

1. Always protect open and confined spaces with standard construction guards and warning devices.

2. Place approved warning lights or reflector signs near areas where work is performed below grade in vaults or manholes. Area shall be barricaded to prevent staff access to work area. Warning lights, barricades and signs shall be placed:

a. One-half hour before sunset or anytime vision is impaired by fog, haze, etc.
b. Signs and lights must remain in place until the work is completed.

c. When below grade work is being performed and work area is left uncovered and unattended, the contractor shall place warning signs with flags, boundary warning tape and cones in the direction of approaching pedestrian or vehicle traffic.
d. When work is located near a curve in walkway/roadway or near a top of hill, place additional warning devices to give sufficient warning to approaching pedestrian or vehicular traffic.
e. Work located in public or private intersections, on public or private surface streets or where traffic is heavy additional precautions shall be deemed necessary and the contractor is to provide for public and staff safety at all times.

3. Materials, tools, vehicles and equipment shall be placed and positioned to cause minimal interference with traffic. Materials, tools, vehicles and equipment shall be configured and arranged on the site and in the work area to minimize hazards to traffic, staff or personnel.

4. Provide protection around all pull lines and/or cable.

5. When equipment, vehicles, tools, materials must be left at the site, unattended, it shall not be secured to posts, poles, furniture, buildings, fencing, or fire hydrants.

B. WORK SPACE BELOW GRADE

1. Confined spaces below grade (manholes, handholes, vaults, tunnels, etc.) are required to be tested for hazardous gas prior to entering. Confined spaces shall not be entered until LOCAL SAFETY procedures have been followed to entering below grade work space.

2. If a hazardous substance is detected in the confined work space, the contractor shall immediately notify owner and consultant and the appropriate gas utility company.

3. Report all trapped or unconscious victims to 9-1-1 and owner.

4. Open flame of any type is not allowed into below grade or confined work spaces.

5. Below grade work spaces shall be ventilated in accordance with LOCAL SAFETY guidelines prior to commencement of work.

6. Use only approved lighting in below grade/confined work spaces.

7. Contractor shall take extreme caution and care while working in existing below guard confined spaces to prevent damage to existing lines, wires, cables, circuits, etc.

C. WORK SPACE ABOVE GRADE

1. Contractor shall protect work area as defined in SIGNS, BARRICADES and MARKING TAPE.

3.7 INSPECTION

A. Conformance to the installer practices covered above are to be verified when completed. In some cases, the customer may inspect before acceptance. The following points are to be examined:

1. Is the design documentation complete?
2. Have all terminated cables been tested per the specifications?
3. Is the cable type suitable for its pathway?
4. Have the pathway manufacturer's guidelines been followed?
5. Have the installers avoided excessive cable bending?
6. Have potential EMI sources been considered?
7. Is cable fill correct?
8. Are hanging supports within 60" (5')?
9. Does hanging cable exhibit some sag?
10. Are telecommunications closet terminations compatible with applications equipment?
11. Have station jack instructions been followed?

    a. Jacket removal point.
    b. Termination positions.
    c. Pair terminations tight with minimal pair distortions.
    d. Twists maintained up to termination.

12. Have patch panel instructions been followed?

    a. Cable dressing first.
    b. Jackets remain up to the connecting block.
    c. Pair terminations tight and undistorted.
    d. Twists maintained up to the connecting block.

13. Are the correct outlet connectors used (568B)?
14. Is the jacket stripped back only as much as is needed, not to exceed 2" from the connection?

3.8 QUALITY CONTROL

A. Evidence of Experience and Qualifications

1. Show that the installer who will perform the work has a minimum of 5 years experience successfully installing system of the same type and design as specified herein. Include the names, locations, and points of contact of at least two similar installations of the same type and design as specified herein where the installer has installed such systems. Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months.

2. Show that the instructor, who will train staff, operating and maintenance personnel, has received a minimum of a CNE/MCE training from a factory training center, and 2 years experience in the installation of systems of the type specified. Submit training certification in equipment submittals, title section training and certifications.

3.9 INSTALLATION TESTING

A. SYSTEM TESTING REQUIREMENTS-STATION

1. Owner/Consultant shall be notified one week prior to any testing so that the testing may be witnessed.

2. Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable for fiber optic and all copper plant wiring.

3. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including but not limited to twisted pair cable, cross-connect blocks, and outlet devices specified in the Products paragraph) and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
4. At a minimum, the Contractor shall test:

    a. All station drop cable pairs from HC/IC/MC termination patch panels to outlet device 8-position modular jacks.
    b. Each wire/pair shall be tested at both ends for the following (utilizing the attached test results forms):

        (1) Termination order.
        (2) Polarity (pair reversals).
        (3) Continuity.
        (4) Shorts.
        (5) Grounds.
        (6) NEXT (near end crosstalk) from both directions.
        (7) Cable length (record all length).
        (8) Wire Map
        (9) Length
        (10) Impedance
        (11) Resistance
        (12) Capacitance
        (13) Attenuation
        (14) Active ACR
        (15) INJ NEXT Loss
        (16) INJ Active ACR

    c. Testing shall be made utilizing a hand cable tester as manufactured by Fluke, Microtest or Wavetek.
    d. All test equipment shall bear current calibration stickers or dated certificates.
    e. Printed test results along with as-built drawings shall be assembled into a 3-ring project binder and delivered to the Consultant for verification and acceptance.

5. When errors are found, the source of each error shall be determined, corrected, and the cable re-tested. All defective components shall be replaced and retested. Defective components not corrected shall be reported to owner/consultant with explanations of the corrective actions attempted.

6. Test records shall be maintained using the test results forms outlined below. The form shall record closet number, riser pair number or outlet ID, outcome of test, indication of errors found (e.g., a, b, c, d, or e) cable length, re-test results after problem resolution and

signature of the technician completing the tests. See Appendix to electrical specifications for testing form.

7. Test results for each 4- pair, Category 5e or 6e, STP cable must be submitted with identification to match labels on all patch panel ports and 8-position modular jacks, and identification to match as-builts associated with that cable.

8. Owner will observe and verify the accuracy of test results submitted.

B. SYSTEM TESTING REQUIREMENTS - CABLE PLANT

1. All data drop cables shall be tested for continuity and polarity between station jack, IDF and MDF.
2. All data trunk cables shall be tested for continuity and polarity between
3. IDF and MDF, using a portable handheld Analyzer. Certify tests in writing.
4. All testing shall be performed in accordance with EIA/TIA building standards and shall be done in the presence of the Consultant.
5. Transmission measurements shall be taken at random to ensure overall system compliance. Tests shall be conducted as follows:

   a. Using a network analyzer, coax cables, baluns, UTP test leads and impedance matching terminations perform the following;

      (1) refer to TIA/EIA/TSB-40

   b. Log all tests in acceptance testing manual. Record and document the following for each cable and circuit.

      (1) Continuity
      (2) Polarity

6. All testing equipment shall have current calibration stickers firmly affixed to the testing equipment. All calibrations shall be traceable to the National Standards Bureau.
7. Provide printed test data for CAT-5e certification for LAN service.
8. Testing shall be performed in the presence of owner and consultant.
9. Testing shall include verification of:

   a. Cable Plant

3.10 FIBER OPTIC TESTING SPECIFICATIONS

A. All testing shall be performed by trained personnel.

B. For all installed fiber optic cable EIA 455-171 Method D procedures will be adhered to. (Bi-directional).

C. Connector loss shall not exceed .5 dB per termination.

D. The fiber optic cable shall not exceed 1.5 db per kilometer tested at 1300 nm and 1500 nm for single mode cable.

E. The fiber optic cable shall not exceed 4 db per kilometer tested at 850 nm and 2 db per kilometer tested at 1300 nm for multimode 62.5/125 fiber.

F. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer's specifications.

PART 4 - WARRANTY SERVICE & CLOSE OUT

4.1 MINIMUM WARRANTY

A. The cabling system shall meet the performance requirements of the ANSI/TIA/EIA-568-A standard (Annex E) and TIA/EIA Telecommunications Systems Bulletin 67. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of at least 15 years. The connecting hardware shall have a lifetime extended warranty against defects in material and workmanship.

B. The warranty must include the following statements regarding the cabling system:

1. "Will support and conform to TIA/EIA-568-A specifications covering ANY CURRENT OR FUTURE APPLICATION which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-A AnnexE and TIA/EIA-TSB-67."

2. "Will be free from defects in material or faulty workmanship"

3. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by Consultant.

4.2 COMMISSIONING

A. General

1. Acceptance shall consist of the following:

a. Burn-in period.

(1) The system shall be accepted for start of warranty upon successful completion and testing of the Consultant.
(2) Burn-in period shall be a 30-day time frame to allow the system to operate free of defects, grounds, programming faults, etc.
(3) The 30-day burn-in shall begin the day of acceptance by Consultant.
(4) The burn-in period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
(5) Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner’s personnel and correct said deficiencies.
(6) Upon correction and restoration, the burn-in period shall be re-set to “0” and the 30 day count shall begin again.
(7) Warranty shall commence upon day 31 of successful burn-in period.

b. Final Test

(1) Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:

(2) The contractor's job foreman, in the presence of a representative of the manufacturer, and a representative of the owner shall operate every network device to ensure proper operation and correct configuration at the file server location.

(3) When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to owner.

(4) The contractor shall leave the data network system in proper working order, and, without additional expense to owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the Consultant.

4.3 PROJECT CLOSE OUT

A. Operating and Instruction Manuals

1. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to owner upon completion.

2. Provide necessary training and/or schooling to designated owner’s personnel at no additional cost to owner. Training shall be at owner’s designated location, by factory-trained personnel.

B. Testing Frequency Instructions

1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to owner upon completion of the system.

2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

a. Instruction on replacing any components of the system, including internal parts.
b. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions
c. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
d. User operating instructions, shall be provided prominently displayed on a separate sheet located next to the control.

3. Owner shall be furnished with all programming disks for each installation as well as hard copy printouts. Provide necessary training and/or schooling to designated owner's personnel at no additional cost to owner. Training shall be at owner's designated location, by factory-trained personnel.

4. Staff of owner maintenance shall be thoroughly instructed in the use of the System. Training shall include a minimum of three (1) hour sessions, to be scheduled at owner's designated time.

5. Maintenance instruction shall be performed in the same manner as described above. Training shall include a minimum of three (1) hour sessions, to be scheduled at owner's designated time.

4.4 DRAWING DETAILS (AS-BUILTS)

A. Show wall elevation and wire details on shop drawings. Show equipment function, make and model and wire routing and terminations within rack or cabinet.

B. Show as-built location of all devices on as-built drawings.

1. Provide 3 sets of bound operation and maintenance manuals, including submittal materials, and record of field changes. Provide complete as-built wiring diagrams in AutoCAD R2000 format. Provide disk files and original tracings (E size) in format of construction drawings.

C. As-Built Drawings, Testing, and Maintenance Instructions

1. A complete set of reproducible as-built drawings in AutoCAD R2000 format (CDs and sheets) showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to owner upon completion of system acceptance.

END OF SECTION 16 750

SECTION 16 901 - GENERAL CONTROL DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pushbutton and selector switches.

B. Control stations.

C. Relays.

D. Time delay relays.

E. Control power transformers.

F. Control panels.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Control Cabinets: Section 16130.

1.3 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control Systems.

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

D. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type.)

E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of Section 0100.

B. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

C. Product Data: Provide for each component showing electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Contactors:

1. Mechanically and Electrically Held Contactors: Open type, 120V coil, number of poles and ampere rating as indicated. Factory wired and installed in lighting panelboard compartment.

a. Square D Co. Class 8903.

B. Time Switch:

1. Intermatic time switch as shown on the drawings.

C. Photo-Control With Time Delay:

1. Rated for 1000W load or 1800 VA, sp-st, in weatherproof enclosure.
2. General Electric Co. Cat. No. CR174H651, or equal.

D. Control Relays:

1. 120 VAC coil, 10A rated contacts with number of poles indicated. Square D Co. Class 8501 Type X.
2. 48 VDC coil, 10A rated contacts. Square D Co. Class 8501 Type KDP-12.
3. 24 VDC coil, 10A rated contacts, plug-in Type 3PDT. Square D Co. Class 8501 Type KDP-13 with NR62 socket.
4. Pneumatic Time Delay Relay: Square D Co. Class 9050 Type B.

E. Control Units, Such as Push Buttons, Pilot Lights, Selector Switches: Heavy duty, oil tight - Square D Co. Class 9001.

1. Push buttons, standard, full guard. Red for stop, green for start.
2. Pilot lights, transformer type, with color caps as indicated.
3. Selector switches, 3 position (Hand-Off-Automatic) manual return.
4. Legend Plates: Standard, with legends as indicated.

2.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates with 1/4-inch minimum height letters indicating circuit designation of panel or device controlled on controls which are individually enclosed.

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION 16 901

SECTION 16 920 - MOTOR CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Motor control; including molded case circuit breakers or fusible disconnects, magnetic starters and other control devices.

1.2 SUBMITTALS

A. Submit in accordance with Section 16000.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Motor Rated Switches: Section 16170.

B. Control Units: Section 16901.

C. Control Section: Division 15.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Motor Control Centers:

1. Provide factory assembled motor control centers consisting of one or more, minimum: 19 inch wide by 16 inch deep, dead front, dead rear, vertical sections bolted together.
2. Full voltage, non-reversing starter, unless otherwise indicated.
3. Conform with NEMA Class 1, Type B wiring for starter unit control.
4. Provide two normally open and one normally closed auxiliary contacts on each except where more contacts are indicated.
5. Provide full length copper bussing including areas indicated as space only.
6. Provide a horizontal copper ground bus drilled and tapped every 10 inches for 1/4-20 machine screws.
7. Provide an individual control transformer with the secondary fused and grounded for each starter. Size as required for the control devices indicated plus 25% spare capacity minimum.
8. Provide a 3-position selector switch (hand-off-auto), manual return, for each starter unless otherwise indicated.
9. Provide a transformer type push-to-test green pilot light energized by an auxiliary contact.
10. Provide approved pull apart terminal blocks or control circuit disconnect switch for all external wiring connections.

11. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.
12. Allen-Bradley, GE or Square-D Co.

B. Combination Motor Starters:

1. Full voltage, non-reversing starters unless otherwise noted and magnetic trip only circuit breakers, or fusible disconnects in NEMA 1 enclosure for dry areas and NEMA 3R where indicated weatherproof, sized as indicated. Provide current limiters where indicated.

2. Provide two normally open and one normally closed auxiliary contacts on each starter, except where contacts are indicated.

3. Provide an individual control transformer with the secondary fused and grounded for each starter. Size as required for the control devices indicated plus 25% spare capacity minimum.

4. Provide a 3-position selector switch (hand-off-auto), manual return, for each starter unless otherwise indicated.

5. Provide a transformer type push-to-test green pilot light energized by an auxiliary contact.

6. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.

7. Combination Starter and Circuit Breaker: Square-D Co. Class 8539, GE or Allen-Bradley.

8. Combination Starter and Disconnect: Square-D Co. Class 8538, GE or Allen-Bradley.

C. Motor Manual Starters:

1. Single Phase:

a. For fractional HP motors, single unit with toggle operator, in NEMA 1 enclosure for dry areas and NEMA 3R where indicated weatherproof.
b. Number of poles as indicated.
c. Provide overload protection.
d. Square-D Co. Class 2510, GE or Allen-Bradley.

2. Three Phase:

a. For integral horsepower motors, single unit 3-pole with toggle operator in NEMA 1 enclosure for dry areas and NEMA 3R where indicated weatherproof.
b. Square-D Co. Class 2510, GE or Allen-Bradley.

D. Magnetic Motor Starters (Individually Mounted):

1. Non-reversing, in NEMA 1 enclosure for dry areas and a NEMA 3R enclosure where indicated weatherproof.

2. Provide start-stop push button on door otherwise indicated.

3. Square-D Co. Class 8536, GE or Allen-Bradley.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bolt all sections of the control centers together tightly and secure to floor with anchor bolts after setting assembly plumb and level.

B. Secure units to structures to withstand wire-pulling strains.

C. Use motor nameplates data for selection of heater elements in motor starters, except where power factor correction is used. Size heater elements accordingly.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all electrical distribution equipment shown on the single line diagram.

B. Provide motor control center and source feed designation on nameplates with 3/8" minimum lettering for the motor control center name and 1/4" height lettering for the source feed designation.

EXAMPLE: MCC-A
FED FROM: DHA-1

C. Provide engraved plastic nameplates with 1/4-inch minimum height letters indicating circuit designation at branch overcurrent devices in motor control centers.

1. Circuit designation and load served at branch overcurrent devices in motor control centers and combination starters.
2. Circuit designation and load served at manual motor starters and individually mounted magnetic motor starters.

D. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation is not acceptable.

END OF SECTION 16 920

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 22 Sections, in addition to the general requirements.

B. Plumbing work includes the following: furnish and install all piping and plumbing fixtures shown on the plumbing, mechanical, architectural drawings described in these specifications. In connection with this work, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said systems properly and safely operable, including, but not limited to, mounting hardware, framing, insulation, valves, flashing, cleanouts, cutting, concrete coring and cutting, patching, and fixture installation.

1.2 WORK SEQUENCE

A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Mechanical, Plumbing, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

B. Coordinate related work and modify surrounding work as required.

1.3 SUBMITTALS

A. Submit on the following:

1. All pipe, fittings, insulation, hangers and supports, labels, fixtures, adhesives and sealants, and equipment that is planned to be installed on this project.

B. Proposed Products List: Include Products specified in the following Sections:

1. Division 22 - Plumbing.
2. Project Drawings.

C. Submit product data grouped to include complete submittals of related systems, products, and accessories in a single submittal bound in a three ring binder with table of contents and section tabs. See specification Division 13 for additional submittal requirements; shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

D. Equipment and materials shall be ordered only after satisfactory review by Architect and Engineer.

E. The following statement applies to all items reviewed: "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

F. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

G. The first submittal shall be comprehensive and complete. Partial submittals will be returned without review.

1.4 REGULATORY REQUIREMENTS

A. Conform to 2016 California Building Code.

B. Fire Protection: Conform to 2016 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.

C. Plumbing: Conform to 2016 California Plumbing Code.

D. Mechanical: Conform to 2016 California Mechanical Code.

E. Electrical: Conform to 2016 California Electrical Code.

F. Obtain approved inspections from authority having jurisdiction.

G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.5 PROJECT / SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Owner before proceeding.

C. Piping Locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes.

D. Construction Observation: In addition to the requirement for obtaining inspections by the local jurisdiction, Contractor shall notify Engineer and commissioning agent at appropriate times during the construction process so that they can visit site to become generally familiar with the progress and quality of Contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

E. Scaling of Drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime Contractor shall request in writing that the Architect or the Engineer provide clarification or the specific dimension.

1.6 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workmen, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.

C. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power-using equipment shall meet the California energy efficiency standards as defined in the current Title 24 requirements.

D. Welding procedures and testing shall comply with ANSI Standard B31.1.0 standard code for pressure piping and the American Welding Society – Welding Handbook. Welding shall also comply with Division of the State Architect and structural plan requirements for materials, procedures, qualifications, and inspections.

1.7 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, the contractor shall immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and the sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award, and if appropriate a deductive change order will be issued.

D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

1.8 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

B. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

C. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

D. Protect materials stored at site and installed from damage. Verify dimensions of equipment and fixtures prior to ordering.

E. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
2. Provide offsets, transitions, and changes in directions of pipes as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required. It is the intent of this paragraph that all cost associated with compliance be borne by the contractor.
3. All equipment shall be firmly anchored to building structural elements.
4. Carefully check space requirements with other trades and existing conditions to insure material, fixtures or equipment can be installed in the spaces allotted.

C. Install all plumbing fixtures and equipment to allow for service.

3.2 COMMISSIONING

A. Provide checklist with each fixture detailing the operational status of all plumbing fixtures and have been adjusted and tested for proper operation.

3.3 SPECIAL TOOLS AND TRAINING

A. The contractor shall provide to the owner any special tools need to service and access the equipment provided in this contract.

B. The plumbing shall provide to the owner two hours of training on cleaning and maintenance of the new plumbing equipment.

END OF SECTION 220500

SECTION 22 05 10

PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions and Division 01 specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings for domestic water, condensate drains, waste and vent.
2. Escutcheons.
3. Cleanouts.
4. Vandal-proof vent caps.
5. Supply tubes & Angle Stops.

1.3 REFERENCES

A. ANSI B31.9 - Building Service Piping.

B. ASME B16.3 - Malleable Iron Threaded Fittings.

C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

D. ASTM A47 - Ferritic Malleable Iron Castings.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM A74 - Cast Iron Soil Pipe and Fittings.

G. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

H. ASTM B32 - Solder Metal.

I. ASTM B88 - Seamless Copper Water Tube.

J. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

K. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

L. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).

M. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

N. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

O. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.

P. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.

Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

S. NSF – Third Party Testing for No-hub Couplings.

T. ASTM D2513 - SDR11.5 Polyethylene Gas Pipe.

U. ASTM D1784 – Low Extractable Polyvinyl Chloride for filtered water.

V. ANSI 31.2 – Fuel Gas Piping.

W. ASTM D2513 – SDR11.5.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Piping and fittings.
2. Escutcheons.
3. Cleanouts.
4. Vandal-proof vent caps.
5. Supply tubes & angle stops.

B. Project Record Documents

1. Submit the following:
2. Record actual locations of valves and piping.

C. Operation and Maintenance Data

1. Submit the following:
2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 REGULATORY REQUIREMENTS

A. Perform Work in accordance with 2016 California plumbing code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of the general requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GROUND

A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper, US - Manufactured.

1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings, with lead-free solder.
2. Bronze Flanges: ASME B16.24, class 150, with solder-joint ends.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. All copper and fittings shall be made in the United States.

2.2 CONDENSATE DRAIN PIPING

A. Hard Copper Tube: ASTM B88, type L water tube, drawn temper, US - Manufactured.

1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings.
2. Non lead bearing solder
3. Provide cleanouts with threaded plugs every 30 feet and at changes of direction.
4. Slope a minimum of 1/8” per foot to drain with no bellies in the pipe slope.

2.3 SANITARY WASTE AND VENT PIPING

A. Within the building and out 5 feet

1. Hubless cast-iron pipe and fittings: ASTM A888 or CISPI 301 of US manufacture.
2. Standard shielded couplings, stainless steel: CISPI 310, NSF-certified.
3. Heavy-duty couplings, stainless steel: ASTM C564, NSF - certified. Use four-band clamps at all rainwater piping and sanitary waste piping greater than 2”.
4. All cast-iron pipe and fittings and couplings shall be manufactured in the U.S.
5. Minimum slope ¼” per foot to drain with no bellies in piping.

6. All underground waste piping shall be in a pipe trench per detail 8/P-4.0

2.5 ESCUTCHEONS

A. Escutcheons for gas, condensate, water and waste, and vent piping penetrations.

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. Brasscraft or equal

2. Description: chrome-plated cast brass with set screws.

2.6 CLEANOUTS

A. Cleanouts for waste piping.

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:

a. J.R. Smith
b. Zurn.

2. Description: cast-iron with threaded bronze plug. 18 gage stainless cover with vandal-proof screws for wall cleanout. Polished brass non-slip cover for floor cleanout. Concrete box for cleanout to grade.

2.7 VANDAL-PROOF VENT CAPS

A. Vandal-proof vent caps

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:

a. J.R. Smith
b. Zurn.

2. Description: cast-iron dome secured with recessed Allen Key Set screws.

2.9 SUPPLY TUBES

A. Supply tubes:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. Brasscraft Speedi Plumb Plus.

2. Description: braided stainless steel with PVC inner hose, 1/2” FIP x 3/8” COMP.

3. IAMPO Listed.
4. Lead-free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Establish elevations of buried piping outside the building to ensure not less than 30 inch of cover. Exception: Localized areas may be 18” deep to accommodate existing conditions.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

M. Excavate in accordance with this Section for work of this Section.

N. Backfill in accordance with this Section for work of this Section.

O. Trenching: material shall be excavated from trenches and piled adjacent to the trench. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel. All rock, boulders, and stones shall be removed to provide a minimum clearance of six (6) inches under and around pipes. Excavations shall be kept free of water. Trenches shall be dug to true and smooth bottom grades and in accordance with the lines indicated on drawings and as directed. Trench widths shall not exceed 30 inches or 1.5 times outside diameter of the pipe plus 18 inches whichever is greater. Minimum trench width shall be the outside diameter of pipe installed plus 12 inches.

P. All underground waste within building shall be installed in concrete trench per detail 1/P-4.0.

Q. Test all piping per 2016 California Plumbing Code Requirements

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

B. Slope water piping and arrange to drain at low points.

END OF SECTION 220510

SECTION 22 05 10

PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions and Division 01 specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings for domestic water, condensate drains, waste and vent.
2. Escutcheons.
3. Cleanouts.
4. Vandal-proof vent caps.
5. Supply tubes & Angle Stops.

1.3 REFERENCES

A. ANSI B31.9 - Building Service Piping.

B. ASME B16.3 - Malleable Iron Threaded Fittings.

C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

D. ASTM A47 - Ferritic Malleable Iron Castings.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM A74 - Cast Iron Soil Pipe and Fittings.

G. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

H. ASTM B32 - Solder Metal.

I. ASTM B88 - Seamless Copper Water Tube.

J. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

K. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

L. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).

M. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

N. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

O. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.

P. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.

Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

S. NSF – Third Party Testing for No-hub Couplings.

T. ASTM D2513 - SDR11.5 Polyethylene Gas Pipe.

U. ASTM D1784 – Low Extractable Polyvinyl Chloride for filtered water.

V. ANSI 31.2 – Fuel Gas Piping.

W. ASTM D2513 – SDR11.5.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Piping and fittings.
2. Escutcheons.
3. Cleanouts.
4. Vandal-proof vent caps.
5. Supply tubes & angle stops.

B. Project Record Documents

1. Submit the following:
2. Record actual locations of valves and piping.

C. Operation and Maintenance Data

1. Submit the following:
2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 REGULATORY REQUIREMENTS

A. Perform Work in accordance with 2016 California plumbing code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of the general requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GROUND

A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper, US - Manufactured.

1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings, with lead-free solder.
2. Bronze Flanges: ASME B16.24, class 150, with solder-joint ends.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. All copper and fittings shall be made in the United States.

2.2 CONDENSATE DRAIN PIPING

A. Hard Copper Tube: ASTM B88, type L water tube, drawn temper, US - Manufactured.

1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings.
2. Non lead bearing solder
3. Provide cleanouts with threaded plugs every 30 feet and at changes of direction.
4. Slope a minimum of 1/8” per foot to drain with no bellies in the pipe slope.

2.3 SANITARY WASTE AND VENT PIPING

A. Within the building and out 5 feet

1. Hubless cast-iron pipe and fittings: ASTM A888 or CISPI 301 of US manufacture.
2. Standard shielded couplings, stainless steel: CISPI 310, NSF-certified.
3. Heavy-duty couplings, stainless steel: ASTM C564, NSF - certified. Use four-band clamps at all rainwater piping and sanitary waste piping greater than 2”.
4. All cast-iron pipe and fittings and couplings shall be manufactured in the U.S.
5. Minimum slope ¼” per foot to drain with no bellies in piping.

6. All underground waste piping shall be in a pipe trench per detail 8/P-4.0

2.5 ESCUTCHEONS

A. Escutcheons for gas, condensate, water and waste, and vent piping penetrations.

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. Brasscraft or equal

2. Description: chrome-plated cast brass with set screws.

2.6 CLEANOUTS

A. Cleanouts for waste piping.

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:

a. J.R. Smith
b. Zurn.

2. Description: cast-iron with threaded bronze plug. 18 gage stainless cover with vandal-proof screws for wall cleanout. Polished brass non-slip cover for floor cleanout. Concrete box for cleanout to grade.

2.7 VANDAL-PROOF VENT CAPS

A. Vandal-proof vent caps

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:

a. J.R. Smith
b. Zurn.

2. Description: cast-iron dome secured with recessed Allen Key Set screws.

2.9 SUPPLY TUBES

A. Supply tubes:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. Brasscraft Speedi Plumb Plus.

2. Description: braided stainless steel with PVC inner hose, 1/2” FIP x 3/8” COMP.

3. IAMPO Listed.
4. Lead-free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Establish elevations of buried piping outside the building to ensure not less than 30 inch of cover. Exception: Localized areas may be 18” deep to accommodate existing conditions.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

M. Excavate in accordance with this Section for work of this Section.

N. Backfill in accordance with this Section for work of this Section.

O. Trenching: material shall be excavated from trenches and piled adjacent to the trench. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel. All rock, boulders, and stones shall be removed to provide a minimum clearance of six (6) inches under and around pipes. Excavations shall be kept free of water. Trenches shall be dug to true and smooth bottom grades and in accordance with the lines indicated on drawings and as directed. Trench widths shall not exceed 30 inches or 1.5 times outside diameter of the pipe plus 18 inches whichever is greater. Minimum trench width shall be the outside diameter of pipe installed plus 12 inches.

P. All underground waste within building shall be installed in concrete trench per detail 1/P-4.0.

Q. Test all piping per 2016 California Plumbing Code Requirements

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

B. Slope water piping and arrange to drain at low points.

END OF SECTION 220510

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Brass angle stops.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

F. Lead Content: Comply with State of California laws SB1334.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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

   a. Conbraco Industries, Inc.; Apollo Valves.
   b. NIBCO INC. S-685-80-LF to 2";

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Sweat.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Lead Content: Comply with State of California laws SB1334.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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

   a. NIBCO INC.
   b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.
   g. Crispin Valve.
   h. DFT Inc.

B. Lead Content: Comply with State of California laws SB1334.

2.4 BRASS ANGLE STOPS

A. Brass angle stops, heavy pattern.

1. Subject to compliance with requirements, provide products by the following:
   a. Chicago Faucet

2. Description: heavy pattern, angle, ½" FIP inlet x 3/8" compression, loose key.
3. Lead-free compliant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Domestic Water Shutoff Service: Ball valves.
2. Throttling Service: Globe valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, 2"and Smaller: Soldered ends.
2. For Copper Tubing, 2-1/2" to NPS 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, 2-1/2" and Smaller: Threaded ends.
4. For Steel Piping, 2-1/2" TO 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. For Steel Piping, NPS 5 and Larger: Flanged ends.
6. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

END OF SECTION 220523

SECTION 22 05 29

PLUMBING PIPING AND EQUIPMENT

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Equipment supports shall be capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Design seismic-restraint hangers and supports for piping and equipment per 2007 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is “A.”

C. All exterior steel support components shall be hot-dipped galvanized. All welds shall be ground smooth and painted with three coats of zinc-rich paint.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Mechanical fastener systems.
4. Pipe positioning systems.
5. Trapeze pipe hangers. Include Product Data for components.
6. Metal framing systems. Include Product Data for components.
7. Pipe stands. Include Product Data for components.
8. Equipment supports.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Unistrut
4. Superstrut

C. Galvanized, Metallic Coatings: Hot dipped.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Unistrut Corp.; Tyco International, Ltd.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Power-Strut Div.; Tyco International, Ltd.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated. Exterior components shall be hot-dipped galvanized.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

E. Provide submittal.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated (interior use) Type 304 stainless steel (exterior use), for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Anchor must have ICC report. Provide report with submittal and one copy to the inspector. See State Architect Requirements for testing.

1. Manufacturers:

    a. Hilti, Inc.
    b. ITW Ramset/Red Head.
    c. Or equal.

C. Pre- placed concrete inserts

1. Manufacturers:

    a. B-Line Systems, Inc.; a division of Cooper Industries.
    b. or equal.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. See plans for details.

B. All exterior steel supports shall be hot dipped galvanized.

C. No piping supports shall be mounted directly on roof membrane.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel supports shall be hot dipped galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 .
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
8. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.\

2. Steel bolts with nylon lock nuts and washers
3. Lagscrews
4. Simpson SDS Screws

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use mechanical-expansion anchors or inserts instead of building attachments where required in concrete construction.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install concrete inserts prior to concrete placement per manufacturer’s listing.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

4. Insert Material: Length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Provide 20 gauge sheet metal backing as needed to support equipment and fixture.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING & PERSONNEL PROTECTION

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1/2 inches below nut.

C. Provide personnel protection at mechanical rooms, equipment areas and any equipment maintenance area from strut and threaded rods ends. Install soft protective materials to prevent skin and skull injuries. Install protection as soon as practicable after installation.

3.6 PAINTING

A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Environmental Submittals:

1. LEED Credit EIQ 4.1: Product data for adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content (if applicable).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements,

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000(Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglass Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

a. RPR Products, Inc.; Insul-Mate.

2.2 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. 2" and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
b. Cover with kraft paper vapor barrier jacket and PVC fitting covers.

2.3 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over piping; kraft paper vapor barrier with PVC fitting covers.

B. Piping, Exposed at Lavatories and Accessible Sinks:

1. Truebro LavGuard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

1. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section “Indoor Air Quality (IAQ) Management”.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
6. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section “Indoor Air Quality (IAQ) Management”.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.
5. Edges.

END OF SECTION 220700

SECTION 22 40 00 - PLUMBING FIXTURES-GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 22 42 00 Commercial Plumbing Fixtures

1.2 SUMMARY

A. This Section includes the following plumbing fixtures, equipment, and related components:

1. Faucets for Lavs & sinks.
2. Protective shielding guards.
3. Lavatories & Sinks.
4. Electric water heaters.
5. Shower.
6. Trench / shower drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Accessible Plumbing Fixture Regulatory Requirements: Accessible plumbing fixtures shall comply with all of the requirements of CBC Section 1115B. Height and locations of all fixtures shall be according to CBC Table 1115B-1. Fixture controls shall comply with CBC Section 1118B.

B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in 2016 CEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Vitreous-China Fixtures: ASME A112.19.2M.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Faucets: ASME A112.18.1.

2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
3. NSF Potable-Water Materials: NSF 61.
4. Pipe Threads: ASME B1.20.1.
5. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
6. Supply Fittings: ASME A112.18.1.
7. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:

1. Faucets: ASME A112.18.1.
2. Hand-Held Showers: ASSE 1014.
3. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
4. Pipe Threads: ASME B1.20.1.

K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Brass Waste Fittings: ASME A112.18.2.
2. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

L. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Hot-Water Dispensers: ASSE 1023 and UL 499.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Cartridges and O-Rings: Provide two repair kits for each type faucet except for the mop sink faucet.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Chicago Faucet
b. Comply with California AB 1953 non lead requirements.
c. 0.35 GPM.

B. Sink Faucets:

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

a. Chicago Faucet.
b. Comply with California AB 1953 non lead requirements.
c. 0.5 GPM Flow

2.2 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. TRUEBRO, Inc.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.3 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Kohler.

2. Description: Under-mount, vitreous-china fixture.

a. Type: Drop-in.
b. Faucet Hole Punching: Single.
c. Color: White.
d. With strainers, tailpieces, traps and insulation.

2.4 SINKS

A. Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Elkay.

2. Description: Counter-mounting or free-standing, stainless-steel sink.

a. With strainers, tailpieces, traps and insulation.

2.5 ELECTRIC WATER HEATERS

A. Electric Water Heaters:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. American Water Heaters.

2. Description: With Stand and Smitty pan.

2.6 SHOWER

A. Shower:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. Acorn.

2.7 TRENCH / SHOWER DRAINS

A. Trench / Shower Drains:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

a. J.R. Smith.
b. Zurn.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

Q. Install condensate piping sloping to mop sink.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section.

D. Connect wiring according to Division 26.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

DIVISION 22: PLUMBING

SECTION 22 42 00: COMMERCIAL PLUMBING FIXTURES

GENERAL PROVISIONS:

1. FURNISH AND INSTALL ALL PLUMBING FIXTURES AND ALL SUPPLY AND DRAIN LINES, INCLUDING BUT NOT LIMITED TO ALL MOUNTING HARDWARE, VALVESETS, AND ACCESSORIES.

2. FIXTURES, MATERIALS AND THE INSTALLATION SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.

3. QUALITY CONTROL:

   A. PLUMBING INSTALLATION SHALL BE PER MANUFACTURER'S RECOMMENDED PROCEDURES, CBC, 2016 ED., AND CPC, 2016 ED., AND MEET ALL WATER FLOW REGULATIONS.

   B. ANCHOR THE PLUMBING FIXTURES TO THE FRAMING AS SHOWN ON THE DRAWINGS.

4. DELIVERY AND STORAGE: WHEN DELIVERED TO THE SITE, ALL PLUMBING FIXTURES, TRIM ACCESSORIES, AND PLUMBING FITTINGS, AND MOUNTING HARDWARE SHALL BE COVERED AND PROTECTED FROM DAMAGE.

MATERIALS:

1. PLUMBING FIXTURES AS SHOWN ON THE DRAWINGS, INCLUDING CONCEALED CARRIERS FOR WALL-HUNG INSTALLATION.

2. LAVATORIES (UNDERCOUNTER): KOHLER TAHOE K-2890-4U (WHITE) EQUIPPED WITH CHICAGO FAUCET #802-V 317ABCPD MANUAL VALVESET DECK MOUNTED. THE ENTIRE ASSEMBLY SHALL BE SUPPORTED UNDERCOUNTER. INSTALL QUARTER-TURN BALL VALVES AT ALL UNDERSINK SUPPLY CONNECTIONS.

3. KITCHEN SINK AT BREAKROOM: ELKAY CROSSTOWN 16 GAUGE STAINLESS STEEL 30¾" x 18½" x 8" DOUBLE BOWL UNDERMOUNT EFRU3118 WITH LKFOBG1316SS BOTTOM GRID AND LK99 DRAIN KIT. FAUCET: CHICAGO FAUCET MANUAL HOT AND COLD WATER 1100–HA8AE35-317AB 8-INCH HEIGHT SWING GOOSENECK WITH 8-INCH CENTERS DECK MOUNT WRIST BLADE HANDLES

4. SHOWER VALVES: ACORN APEX 410BADA SERIES, TYPE 1 WITH T/P TEMPERATURE THERMOSTATIC/PRESSURE BALANCING MIXING VALVE.

5. SHOWER DRAIN: ZURN ZS880 STAINLESS STEEL LINEAR DRAIN WITH ANTI-PONDING V-SHAPED CHANNEL w/2-INCH NO-HUB OUTLET. THE GRATE SHALL BE LINEAR SLOTTED AND HEEL PROOF.

6. WATER HAMMER ARRESTORS: PRECISION PLUMBING PRODUCTS # SC-1000 FOR 1-INCH WATER LINES, AND #SC-750 FOR 3/4-INCH WATER LINES WHERE OCCURS, OR SIOUX CHIEF 650/660 SERIES PISTON-TYPE. VERIFY WITH PLUMBING DRAWINGS AND SPECIFICATIONS.

7. PROVIDE AND INSTALL ISOLATION BALL VALVES AT EACH BANK OF PLUMBING FIXTURES-LAVATORIES, TOILETS, URINALS AND SHOWERS RESPECTIVELY. COORDINATE WITH THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATIONS OF VENTURA COLLEGE. SUBMIT MANUFACTURER'S CUT SHEET OF BALL VALVE FOR APPROVAL.

8. CLEANOUT ACCESS COVERS (OVER URINALS): 4-INCH DIAMETER STAINLESS STEEL MIFAB C1440-RD OR C1430-RD SERIES, WHICHEVER IS MOST SUITABLE, INCLUDE PROPER SCREW SIZE AND LENGTH, VERIFY PIPE SIZE.

9. PROVIDE A SCHEDULE OF VALVES, PIPE, MATERIALS, FITTINGS, AND PIPE HANGERS, TOGETHER WITH MANUFACTURER AND CATALOG IDENTIFICATION NUMBER.

PERFORMANCE:

1. INSTALL THE PLUMBING FIXTURES AS SHOWN ON THE DRAWINGS AND PER THE MANUFACTURER'S INSTRUCTIONS. ALL FINISH FOR EXPOSED METAL ON ANY FIXTURE, INCLUDING WALL FLANGES, BOLTS, NUTS, AND WASHERS SHALL BE CHROME PLATED. FIXTURES SHALL BE SEALED TO THE WALL WITH SILICONE CAULK BEAD.

2. WATER HAMMER ARRESTORS SHALL BE INSTALLED WITHIN THE FRAMED WALL CAVITY BEHIND ELMDOOR STAINLESS STEEL DW SERIES 12" x 12" ACCESS PANEL DOOR(S), OR J. R. SMITH ACCESS PANEL DOOR(S) #4730, OR APPROVED EQUAL. ACCESS PANEL DOORS AND FRAMES SHALL BE FORWARDED TO THE PARTITION MANUFACTURER FOR THE ROTARY BRUSHED FINISH TO MATCH THE PARTITIONS PRIOR TO INSTALLATION.

3. THE TOILET DESIGNATED AS HANDICAP ACCESSIBLE SHALL BE INSTALLED AT BETWEEN 17-INCHES TO 19-INCHES HEIGHT AS SHOWN ON THE DRAWINGS AND AS MEASURED FROM THE TOP OF THE SEAT TO THE FINISH FLOOR SURFACE.

4. THE WALL-HUNG TYPE URINAL DESIGNATED FOR DISABLED ACCESS SHALL BE INSTALLED WITH THE RIM AT 17-INCHES ABOVE FINISH FLOOR. THE WALL-HUNG TYPE URINAL NOT DESIGNATED FOR DISABLED ACCESS SHALL BE INSTALLED WITH THE RIM AT 24-INCHES ABOVE FINISH FLOOR.

5. INSULATE HOT WATER SUPPLY PIPES WITH WRAPPED INSULATION THAT SHALL BE AP ARMAFLEX BLACK LAPSEAL FLEXIBLE CLOSED CELL ELASTOMERIC THERMAL TUBE INSULATION WITH A SELF-SEALING SYSTEM, AND SHALL BE NEAT IN APPEARANCE AND FULLY SECURED WITH THE MANUFACTURER'S LAP SEALING TAPE.

6. INSULATE DRAIN LINES AND P-TRAPS AT LAVATORIES WITH LAV GUARD-2 E-Z SERIES MOLDED VINYL WASTE PIPE COVERS SIZED FOR EACH RESPECTIVE APPLICATION.

7. PROVIDE EVIDENCE THE AUTOMTIC OPERATION LAVATORY VALVESETS AND FLUSH VALVES ARE FUNCTIONING PROPERLY.

8. COORDINATE ANY WORK NECESSARY INCLUDING FIELD DETAILS WITH THE RESPECTIVE RELATED TRADES TO AVOID CONSTRUCTION DELAYS AND TO MAINTAIN THE REQUIRED CLEARANCES.

9. THE DRAWINGS SHOW THE FINAL LOCATION OF THE PLUMBING FIXTURES. THE CONTRACTOR SHALL VARY THE LENGTHS AND RUNS OF PIPES, AND MAKE OFFSETS DURING THE PROGRESS OF THE WORK AS REQUIRED TO MEET AND AVOID STRUCTURAL AND OTHER INTERFERENCES.

10. ALIGN ALL PLUMBING FIXTURES, CLEANOUT COVERS, ACCESS PANELS, AND ACCESSORIES, ETC. FOR A UNIFORM, PLUMB AND PROFESSIONAL APPEARANCE. MISALIGNED AND OUT-OF-PLUMB INSTALLATIONS SHALL BE RE-INSTALLED TO THE SATISFACTION OF THE DIRECTOR OF FACILITIES, MAINTENANCE AND OPERATINS OF VENTURA COLLEGE.

11. NOTE THE LOCATIONS AND SIZES OF EXISTING UTILITY LINES ARE INDICATED IN AN APPROXIMATE WAY ONLY, AND HAVE NOT BEEN INDEPENDENTLY VERIFIED. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL THE EXISTING UTILITIES RELEVANT TO THE PROJECT BEFORE THE START OF WORK. THE CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT OCCUR BY THE INTSALLER'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL THE UTILITIES.

12. TEST AND ADJUST REGULATORS TO RECOMMENDED SPECIFIED REDUCED PRESSURES. TEST AND SET ALL SAFETY AND RELIEF VALVES TO THE SPECIFIED RELIEF PRESSURE. TEST AND ADJUST ANY GAUGES, THERMOMETERS, ALARMS AND OTHER SIMILAR INSTRUMENTS TO ASSURE ACCURATE OPERATION.

13. TEST DRAINAGE SYSTEMS TO HOLD WATER FOR FOUR (4) HOURS.

14. TEST WATER SUPPLY SYSTEM HYDROSTATICALLY FOR FOUR (4) HOURS.

15. PROTECT ADJACENT WALL TILE FROM DAMAGE DURING INSTALLATION AND REPAIR AS REQUIRED.

16. ALL FIXTURE AND ACCESSORY INSTALLATIONS SHALL BE WIPED CLEAN OF ANY EXCESS GROUT, SEALANT AND OTHER DEBRIS.

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Sleeves.
3. Escutcheons.
4. Equipment installation requirements common to equipment sections.
5. Painting and finishing.
6. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Proposed Products List: Include all materials specified Division 23 including split system, refrigerant piping, insulation, grilles and registers, ducting, air balance supports and anchors, equipment curbs. Products specified in the following Sections:

1. Division 23 - Mechanical
2. Project Drawings.

B. Equipment and materials shall be ordered only after satisfactory review by Architect and Engineer.

C. The following statement applies to all items reviewed: "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

D. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.

E. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

F. Submit product data grouped to include complete submittals of related systems, products, and accessories in a submittal bound in a three ring binder with table of contents and section tabs. Product sheets shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

G. The first submittal shall be comprehensive and complete.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

D. Coordinate with all other trades for duct & piping paths, access for service, minimizing offsets and transitions, and support & bracing.

1.7 REGULATORY REQUIREMENTS

A. Conform to 2016 California Building Code.

B. Fire Protection: Conform to 2016 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.

C. Plumbing: Conform to 2016 California Plumbing Code.

D. Mechanical: Conform to 2016 California Mechanical Code.

E. Electrical: Conform to 2016 California Electrical Code.

F. Obtain approved inspections from authority having jurisdiction.

G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.8 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.

C. Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor. Any proposed significant deviations from the drawings shall proceed only after satisfactory review by Owner and Engineer. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.

D. Duct locations: Heating and air conditioning unit, piping and duct locations shown are approximate only. Contractor shall verify locations of all structural members and existing conditions in the field, and locate units and ductwork to avoid interference. All clearances required by unit manufacturer shall be maintained. Entire installation shall be in accordance with codes and the recommended installation procedures published by the manufacturers. It is not the intent of the drawings to show necessary offsets and transitions required to avoid

structure or other trades. Contractor shall provide all needed offsets and transitions to avoid structure and other building elements.

E. Construction observation: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

F. Scaling of drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provides clarification or the specific dimension.

1.9 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.

C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

G. All equipment and materials shall be installed in a neat and workmanlike manner.

1.10 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.

C. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option"

D. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS

A. Install ducting according to the following requirements and Division 23 Sections specifying duct systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

D. Verify final equipment locations for roughing-in.

E. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment to allow right of way for piping installed at required slope.

E. All equipment, ducts, and piping shall be firmly anchored to building structural elements

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. All welds shall receive three coats of cold galvanizing paint. All exterior steel shall be hot dipped galvanized unless otherwise noted.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

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

B. Field Welding: Comply with AWS D1.1.

3.8 COMMISSIONING

A. All mechanical equipment and controls shall be commissioned and fully-function tested to verify the proper operation. A written operation report of all equipment shall be provided to the engineer and commission agent two weeks prior to substantial completion. The air balance report shall be submitted to the engineer and commission agent two weeks prior to substantial completion.

END OF SECTION 230500

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section(s) “Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is “A.”

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE AND DUCT SUPPORTS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Unistrut Corp.; Tyco International, Ltd.
4. Tolco

C. Coatings: At Interior - Manufacturer's standard finish – At exterior - Hot dipped galvanized.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type interior/exterior steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Install per ICC listing.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. ITW Ramset/Red Head.

C. Wood Screws for secure pipe and duct supports to wood structure

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

a. Simpson SDS Screws
b. or equal with self drilling feature and ICC report

D. Sheet Metal Screws

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

a. TEK Screws
b. or equal with self drilling feature and ICC report

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel shall be hot dipped aluminized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

B. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. All pipes and ducts shall be braced per 2008 SMACNA Seismic Restraint Manual Guidelines For Mechanical Systems. Seismic hazard level is “A”.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Provide lateral bracing, to prevent swaying, for equipment supports.

C. Anchor all equipment to resist seismic motion.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. If material is galvanized spray with cold galvanizing.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply three costs of galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
2. Constant Volume Air Systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Certified TAB reports.

B. Sample report forms.

C. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Verify all systems are in proper working order prior to beginning air balance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine terminal units and verify that they are accessible and their controls are connected and functioning.

I. Examine system pumps to ensure absence of entrained air in the suction piping.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, dampers are open.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Perform traverse at make-up air system to determine air quantity.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

3. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
4. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer’s written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/12 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Comply with submittal requirements in Division 13.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.

2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer’s name and address.
7. Contractor’s name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer’s name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.

g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

E. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.
m. Hydronic heating system flowrates in gpm.

F. Air-Terminal-Device Reports:

1. Unit Data:

a. Fan Speed
b. Air Velocity at outlet.
c. Temperature at outlet during cooling and heating
d. Area served.
e. Make.
f. Type and model number.

G. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 5 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

6. Coordinate with HVAC contractor and Controls Contractor so that they are available during final testing for additional adjustment and commissioning.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

D. Prepare test and inspection reports with changes made during final inspection.

END OF SECTION 230593

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Flexible elastomeric.
b. Mineral fiber.

2. Adhesives.
3. Sealants.
4. Field-applied jackets.
5. Tapes.
6. Securements.

B. Related Sections:

1. Division 01 Section “Indoor Air Quality (IAQ) Management”.
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section “Metal Ducts” for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Flexible Elastomeric for refrigerant pipes: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Glue all joints with manufacturer sealant.

1. Products: Subject to compliance with requirements, include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2.2 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket: Install at exterior locations.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket (0.016" with formed aluminum fittings.

2.3 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, ½ inch.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1). AGM Industries, Inc.; CWP-1.
        2). GEMCO; CD.
        3). Midwest Fasteners, Inc.; CD.
        4). Nelson Stud Welding; TPA, TPC, and TPS.

2.4 GLASS FIBER, FLEXIBLE

A. Manufacturers:

1. Johns Manville Microlite

2. Knauf PermaWick

3. Or equal.

B. Insulation: ASTM C553 C612; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).

2. Maximum service temperature: 250 degrees F (121 degrees C).

3. Maximum moisture absorption: 0.20 percent by volume.

C. Vapor Barrier Jacket

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film 0.0032 inch (0.081 mm) vinyl.

2. Moisture vapor transmission: ASTM E96; 0.04 perm.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Manufacturers:

a. Polyken Model 236.
b. Or equal.

E. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.5 GLASS FIBER DUCT LINER, FLEXIBLE

A. Manufacturers:

1. Certainteed Tough Guard R with ES.

2. Or equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees F (0.035 at 24 degrees C).

2. Maximum service temperature: 250 degrees F (121 degrees C).

C. Adhesive

1. Waterproof fire-retardant type

2.. Manufacturers:

a. Kingco/Glenkote Seal-Flex Model 11-500.
b. Or equal.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

E. Spiral Duct Liner

1. Casco Coated Circliner II

2. Install at all exposed spiral duct.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

3.4 INSTALLATION

A. Install materials in accordance with Manufacturer's instructions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Exposed Spiral Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.

3. Seal and smooth joints.

4. Seal liner surface penetrations with adhesive.

5. Unless indicated otherwise on plans, duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for liner thickness.

3.5 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.6 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS Inch (mm)	FINISH
Supply Ducts	2" (76.2)	Alum. Foil
Return Ducts	2" (76.2)	Alum. Foil
LINER	**THICKNESS Inch (mm)**	**FINISH**
Supply and Return Plenums	2” (76.2)	
Exposed Spiral Ductwork	1" (38.1)	

END OF SECTION 230700

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Division 01 Section “Indoor Air Quality (IAQ) Management”.
2. Division 09 Section “Interior Painting”.
3. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Ductwork materials
2. Sealants and gaskets.

B. Environmental Submittals:

1. LEED Credit IEQ 4.1: Product data for adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Penetrations of smoke barriers and fire-rated construction.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. Omni Duct Systems.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 G-90 at exterior
2. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Welded Connections

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section “Indoor Air Quality (IAQ) Management”.
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

E. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

F. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

G. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

H. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

I. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

J. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

K. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.4 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide a product by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Mason Industries.
5. Unistrut Corporation; Tyco International, Ltd.

2.5 EXPOSED DUCTING

A. Exposed ducting shall be round spiral type with Ductmate spiral connections. Duct shall be cleaned to remove factory oils. Duct shall be free of defects.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch wg and Lower: Seal Class C.
3. Conditioned Space, Exhaust Ducts: Seal Class B.
4. Conditioned Space, Return-Air Ducts: Seal Class C.
5. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section “Indoor Air Quality (IAQ) Management”.

C. Exposed spiral ducting shall have Ductmate Sprialmate connections. No sealant shall be used.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

3.5 CONNECTIONS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Fans:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.
e. Minimum SMACNA Seal Class: C if negative pressure, and C if positive pressure.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."

a. Velocity 1000 fpm or less 45-degree lateral.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

END OF SECTION 233113

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Flange connectors.

B. Related Sections:

1. Division 23 Section "Metal Ducts".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653.

1. Galvanized Coating Designation: G60 (Z180) and G90 (Z275). (Exterior).
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. McGill AirFlow LLC.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Pottorff; a division of PCI Industries, Inc.
    f. Ruskin Company.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Single blade for ducts up to 24”.
    b. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.3 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel for galvanized steel ducts.

D. Material: Stainless steel for stainless steel ducts.

E. Gage and Shape: Match connecting ductwork.

2.4 TURNING VANES

1. Ductmate Industries

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and stainless-steel accessories in stainless-steel ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install turning vanes at all rectangular elbows.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 23 37 13

DIFFUSERS, REGISTERS, GRILLES, & LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Perforated diffusers.

B. Related Sections:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. , include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS – SEE SCHEDULE ON PLANS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design

requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713