CARSON CITY PURCHASING & CONTRACTS
201 North Carson Street Suite 11 Carson City, NV 89701
775-283-7137 / FAX 887-2107
http://www.carson.org/Index.aspx?page=998

NOTICE TO CONTRACTORS - BID #1415-143
BID TITLE "Carson City Animal Services Facility"
Labor Commissioner PWP# CC-2015-116
Engineer's Estimate: $2,900,000
March 17, 2015

Addendum No. 2

Please make the following additions/changes to the above referenced project.

1. The date, time and place for receiving bids remains unchanged.
2. The following clarifications are from questions during the bid process:

Question 1: *On sheet A2.01 the wood column Detail 6.261 looks to be fairly massive when compared to the stone pilasters that support it. However on the Structural Sheet S100 these columns are called out as 6x6s. That is not the massive impression given by the Architect on the South Elevation on A2.01. Is this correct?*
Answer: ***Addition: SK1/A034 dated 03/16/15 Column Detail at Front Entrance***

Question 2: *The vertical cement siding is called out as Hardie Siding. It is not clear whether the Architect wants Hardie Board & Batten or Hardie T-111.*
Answer: ***Panel - HardiePanel Vertical Siding – Select Cedarmill. Batten – HardieTrim Batten Boards – Rustic Grain***

Question 3: *The siding would have to cover to the height of 10'-4". I believe the siding comes in 10' lengths, would you want a Z flashing at 10 feet and Hardie Trim above?*
Answer: ***Delete C1/A507. Replace with SK1/A507 dated 3/16/15 Trim intersection with1x6 HardieTrim Board.***

Question 4: *There should be signs for the two accessible parking spaces. However there is no detail as to whether they go on the building or in concrete or in bollards.*
Answer: ***See City approved drawing, C-5.4.2 "Traffic Sign Installation".***

Question 5: *Is there a STOP sign or stop bar going out to Airport Road?*
Answer: ***No stop sign or stop bars required.***

Question 6: *The accessible spaces and the parking spaces on the asphalt grindings appear to have wheel stops. However, there is no detail as to size or material composition. The updated AS101 sent out with addendum #1 has them removed from the HC spaces, but for the ones out in gravel yard, do you have a standard detail for one of these?*
Answer: ***See drawing, 8' Standard Parking Curb.***

Question 7: *Page TS-56 of the Technical Specifications for Rough Carpentry states: "P. Fire Retardant Treatment: AWPA C20 for lumber and AWPA C27 for plywood; noncorrosive type. Provide at building interior where required by code." Could they please clarify specifically what lumber needs to be treated with a Fire Retardant?*

Answer: No fire retardant lumber is required.

Question 8: *Page TS-59 of the Technical Specifications for Wood Trusses states: "W. Fire Retardant Treatment: AWPA C20 for lumber and AWPA C27 for plywood;" Does this mean the wood trusses need to be treated with Fire Retardant?*

Answer: No fire retardant lumber is required.

3. Make the following changes and/or modifications to the Table of Content, Special Conditions,Technical Specification or plan set:

AS101 ***Delete AS101 dated 2/27/2015 and Replace with AS101 dated 3/17/2015***
Updated notes – OVER-EXCAVATION REQUIREMENTS PER SOILS REPORT
Keynotes 5.101, 5.110, 5.420 - See A8/A304 for details.

A507 ***Delete A5/A507. Replace with SK2/A507 dated 3/17/15***
1x4 HardieTrim Board added at the underside of ***all*** *eave/siding&batten wall intersections around the entire building.*

Specifications:Section 08511 – Vinyl Windows
Clarification: *The U-factor design basis for all windows is 0.31.*

Specifications:Section 09706 – Decorative Flake Epoxy Floor Finish System
Delete:1.03/C. Replace with 1.03/C as follows:

Contractor Experience: Contractor must furnish the following proof of experience.

a. Letter of training from the Approved Material manufacturer stating that contractor has been an approved installer for a minimum of 5 years and has been successful in the installation of the manufacturers Approved Materials on ten (10) projects of similar complexity and size as this project.
b. List of ten (10) projects using the manufacturers Approved Materials on projects of similar complexity and size as this project including Owner's names, current phone number and list of material used on project.
c. Submit resume of the key person(s) who will be performing the actual work using the manufacturers Approved Materials and list a minimum of five (5) projects with different Owners including Owner's names, current phone number, and data sheets on the material used on project.

Note: 5 days prior to bid due date all installers must submit the above requirements to the Architect for qualification review.

Specifications: Section 09706 – Decorative Flake Epoxy Floor Finish System

Delete:1.03/F. Replace with 1.03/F as follows:

Manufacturer Field Services: The installer of the coating system shall contact the material manufacturer during the bidding phase of the project and shall include in the cost of his work, the cost of a manufacturer's field engineering person to be present throughout the duration of all aspects of the work specified in this section as follows:

a. Material Manufacturer shall be responsible for the review of the project conditions that may impact product performance before product installation, including but not limited to project climate, acceptable temperature of substrate and air, acceptable humidity levels of air, acceptable moisture content of substrates to be coated, surface preparation, and all other conditions that are necessary for optimum product performance. The manufacturer's field engineer shall document and verify that all conditions are acceptable prior to commencement of work.

b. The manufacturer's field representative shall submit through the Contractor written approvals of the proposed coating system including manufacturer's recommended applicator, manufacturer's recommended application procedures, and manufacturer's recommended surface preparation.

c. The manufacturer is solely liable for any warranty claims resulting from product failure, whether caused by defective product or improper installation for a period of 5 years. See warranty section: 3.06 for clarification.

d. The materials manufacturer's representative must be present on site for the entire installation which includes but not limited to the pre-installation site conditions evaluation, surface preparation and all phases of the installation of the specified resinous coating system.

e. Installer's bid shall include the cost of the manufacturer's full time field services as a line item in the bid proposal as specified above. Failure to include manufacturer's field services as specified will result in the bid being rejected.

Note: 5 days prior to bid due date all installers must submit the above requirements to the Architect for qualification review. Manufacturer must provide design criteria as specified and must provide the required field services.

Specifications: Section 09706 – Decorative Flake Epoxy Floor Finish System

Delete:1.04/H. Replace with 1.04/H as follows:

H. Manufacturer's Field Services: Submit a letter from the manufacturer stating that the manufacturer has agreed to and will provide the field services as specified in section 1.03 above.

Note: Bidders are encouraged to submit materials that meet the Basis of Design. In order to have a material accepted as an Approved Material for the work outlined herein the items listed in this section 1.04 A-E must be received by the architect for evaluation and approval no less than 5 days prior to the original published bid due date. Approved Materials will be by Addendum only. Submittals circumventing this process will not be approved and will not be acceptable for inclusion in this project.

Specifications: Section TS

Delete: TS 149-158. Replace with 149-257.
Delete: TS 42. Replace with TS 42.

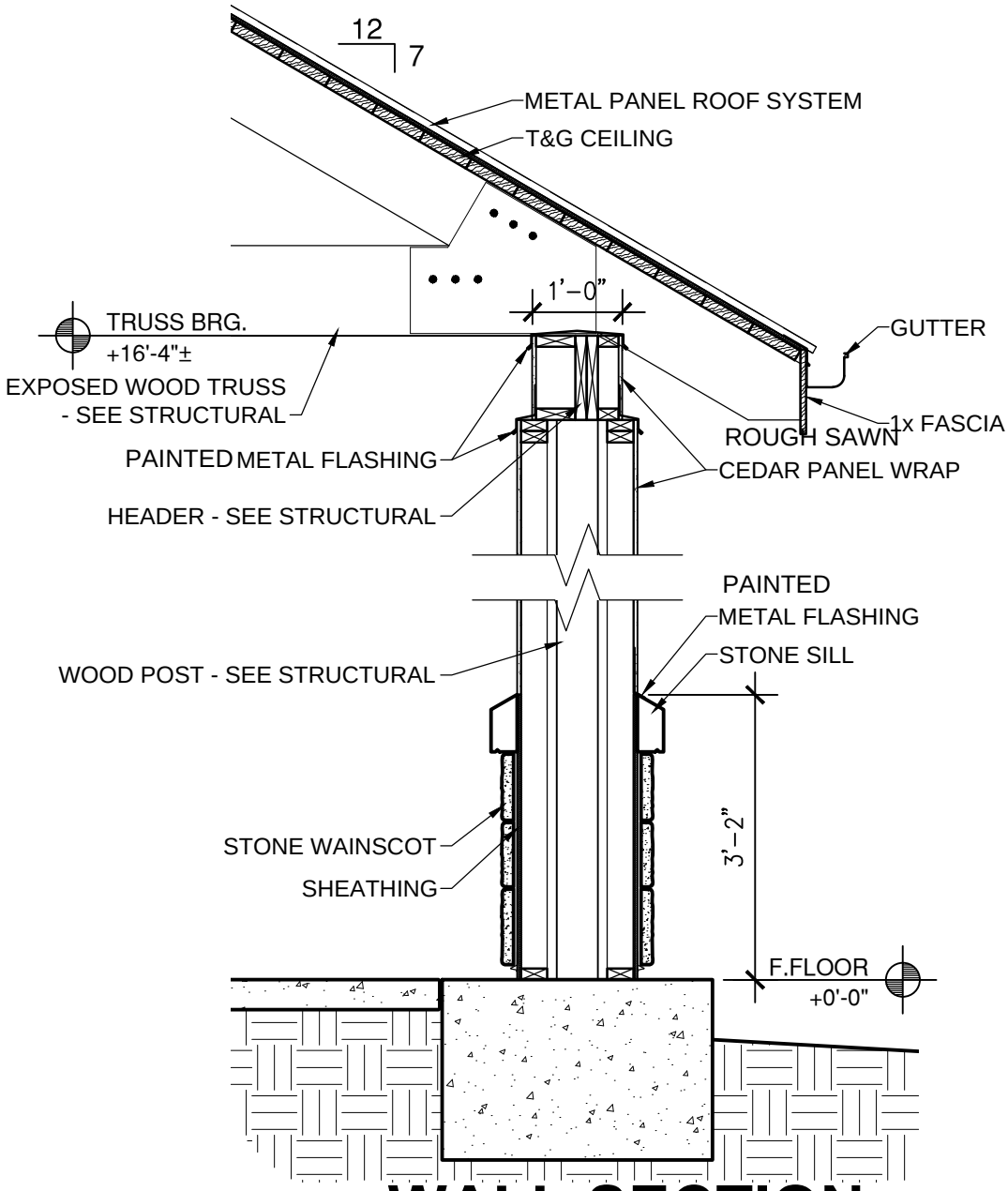
Table of Content:

Delete: TOC-4. Replace with TOC-4

Special Conditions:

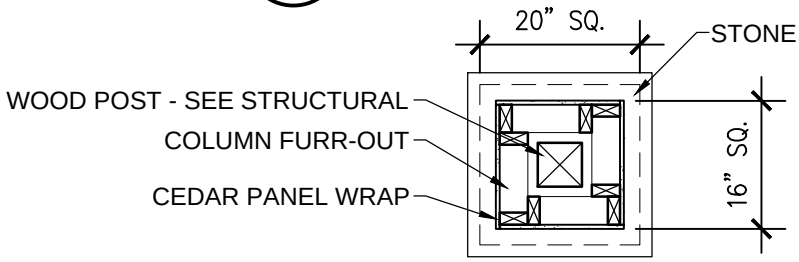
Delete: SC-12. Replace with SC-12
Delete: SC-25. Replace with SC-25

End of Addendum No. 2



B WALL SECTION

1/2" = 1'-0"



A PLAN DETAIL

1/2" = 1'-0"

BDA Architecture, P.C.
Gladysz & Usiak Architecture, LLC
901 Lamberton Pl. NE
Albuquerque, NM 87107
Phone: (505) 858-0180
Fax: (505) 858-0111
Email: info@bdaarc.com

CARSON CITY ANIMAL SHELTER
549 Airport Road
Carson City, Nevada 89701
City of Carson City

WALL SECTIONS
COLUMN DETAIL AT FRONT ENTRANCE

CCAS
PROJECT NO.: 1107
DRAWN:
REVIEWED:
DATE: 3/16/2015

SK1/A304

REFERENCE KEYNOTES

DIVISION 06 - WOOD AND PLASTICS

6.101 - WOOD FRAMING

6.114 - DOUBLE TOP PLATE

6.141 - SHEATHING - SEE STRUCTURAL

6.274 - DECORATIVE WOOD TRUSS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

7.101 - WEATHER RESISTANT BARRIER

7.204 - R-38 BATT INSULATION

7.229 - 2 1/2" RIGID INSULATION

7.402 - BOARD AND BATTEN SIDING

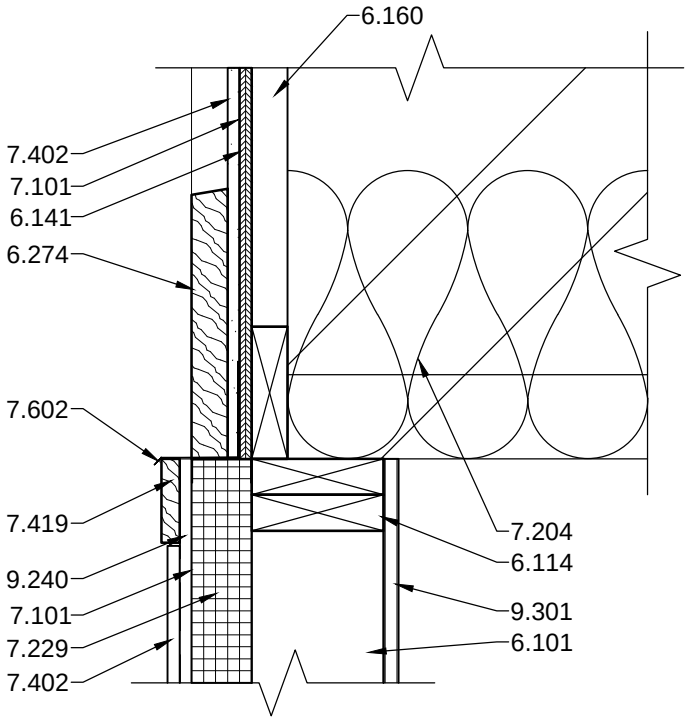
7.419 - 1x6 HARDI BOARD TRIM BOARD FRIEZE

7.602 - METAL DRIP EDGE FLASHING

DIVISION 09 - FINISHES

9.240 - 1/2" RESILIENT FURRING CHANNEL

9.301 - 5/8" GYPSUM BOARD



C1 WALL DETAIL

1 1/2"=1'-0"

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Gladysz & Usiak Architecture, LLC
901 Lamberton Pl. NE
Albuquerque, NM 87107
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Email: info@bdaarc.com

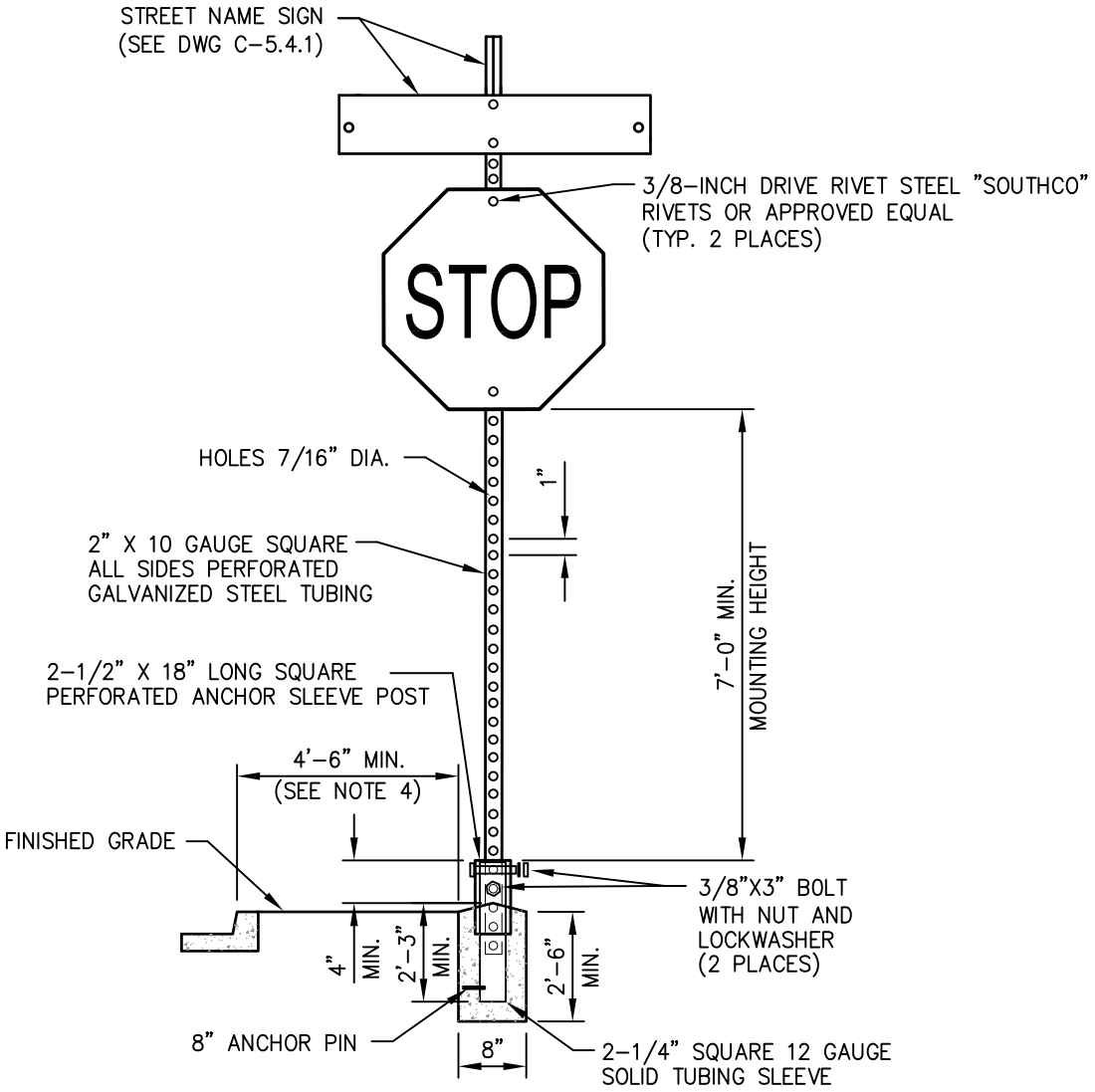
CARSON CITY ANIMAL SHELTER
549 Airport Road
Carson City, Nevada 89701
City of Carson City

ROOF AND WALL DETAILS

TRIM DETAIL

CCAS
PROJECT NO.: 1107
DRAWN:
REVIEWED:
DATE: 3/16/2015

SK1/A507



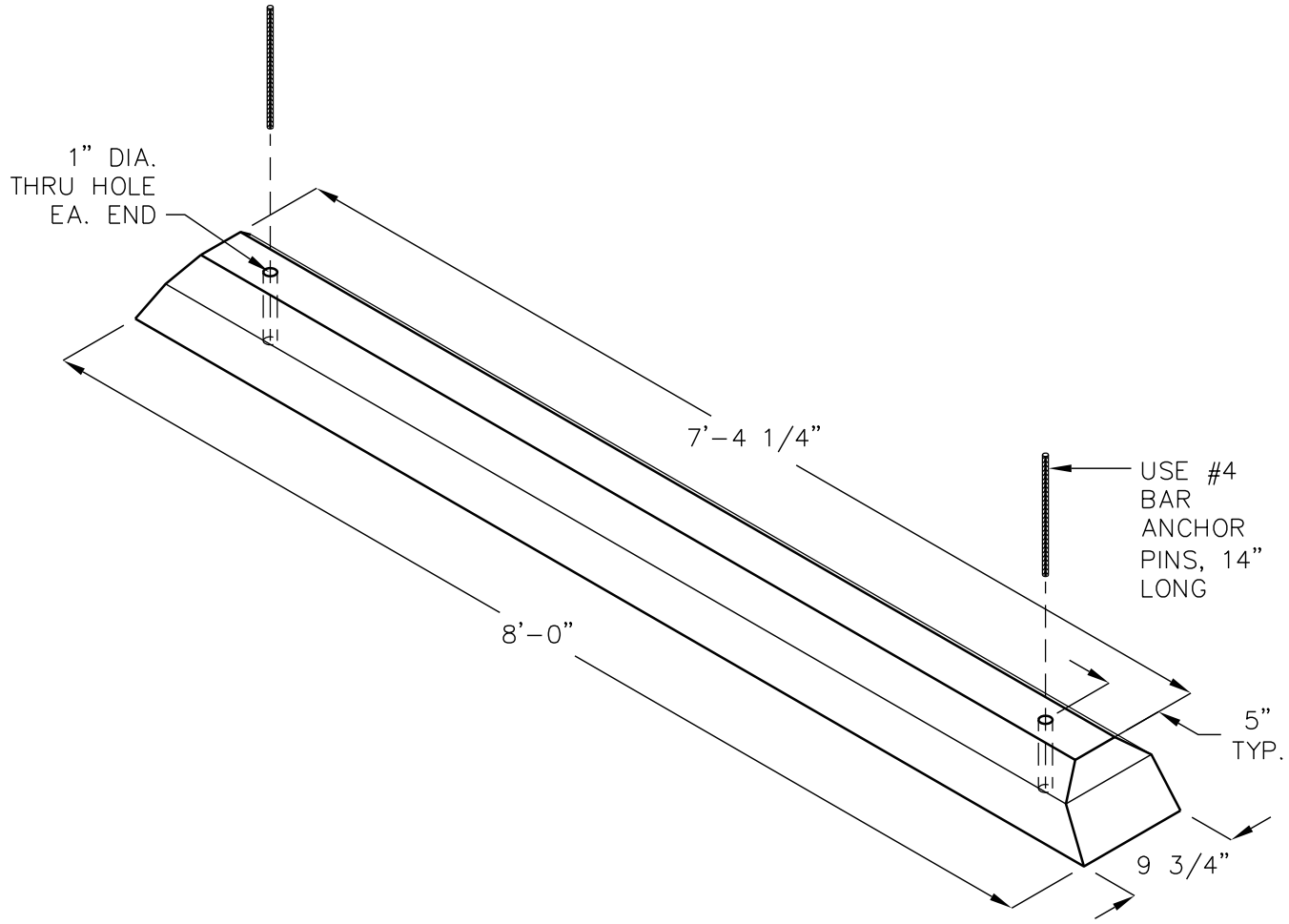
NOTES:

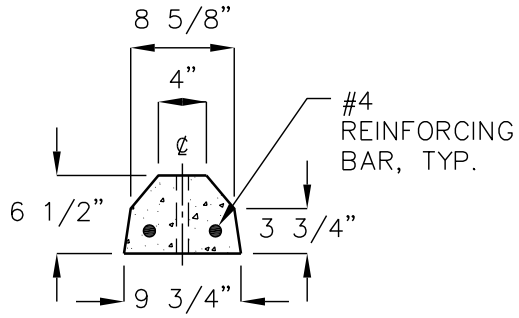
1. SIGN MATERIALS, CONSTRUCTION AND PLACEMENT SHALL BE IN CONFORMANCE WITH THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
2. STREET NAME SIGN SHALL BE AS SPECIFIED IN STANDARD DETAIL DRAWING NO. C-5.4.1
3. ON STREETS WHERE CURBING DOES NOT EXIST, SET SIGN 6 FEET MINIMUM FROM PAVEMENT EDGE.
4. CONCRETE BASE SHALL BE LOCATED AT BACK OF SIDEWALK, UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER.
5. ALL REGULATORY SIGNS SHALL USE ASTM TYPE 3 OR 4 INTENSITY SHEETING.

NO.	REVISION	DATE	STANDARD DETAIL FOR PUBLIC WORKS CONSTRUCTION	SECTION
			TRAFFIC SIGN INSTALLATION	CARSON CITY
				DRAWING NO. C-5.4.2
APPROVED BY:		7/09		DATE 7/2009

8' STANDARD PARKING CURB

WHEEL STOP OR PARKING BUMPERS



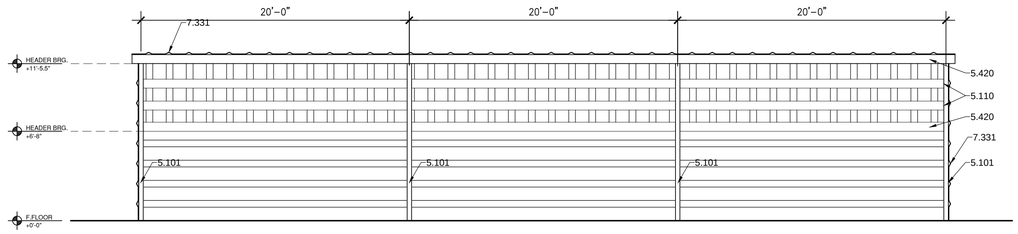


FOR COMPLETE DESIGN
AND PRODUCT INFORMATION
CONTACT JENSEN PRECAST.

APPROXIMATE WEIGHT: 353 LBS.

9/23/02
ParkingCurb.dwg

JENSEN PRECAST®



G1 CARPORT ELEVATION

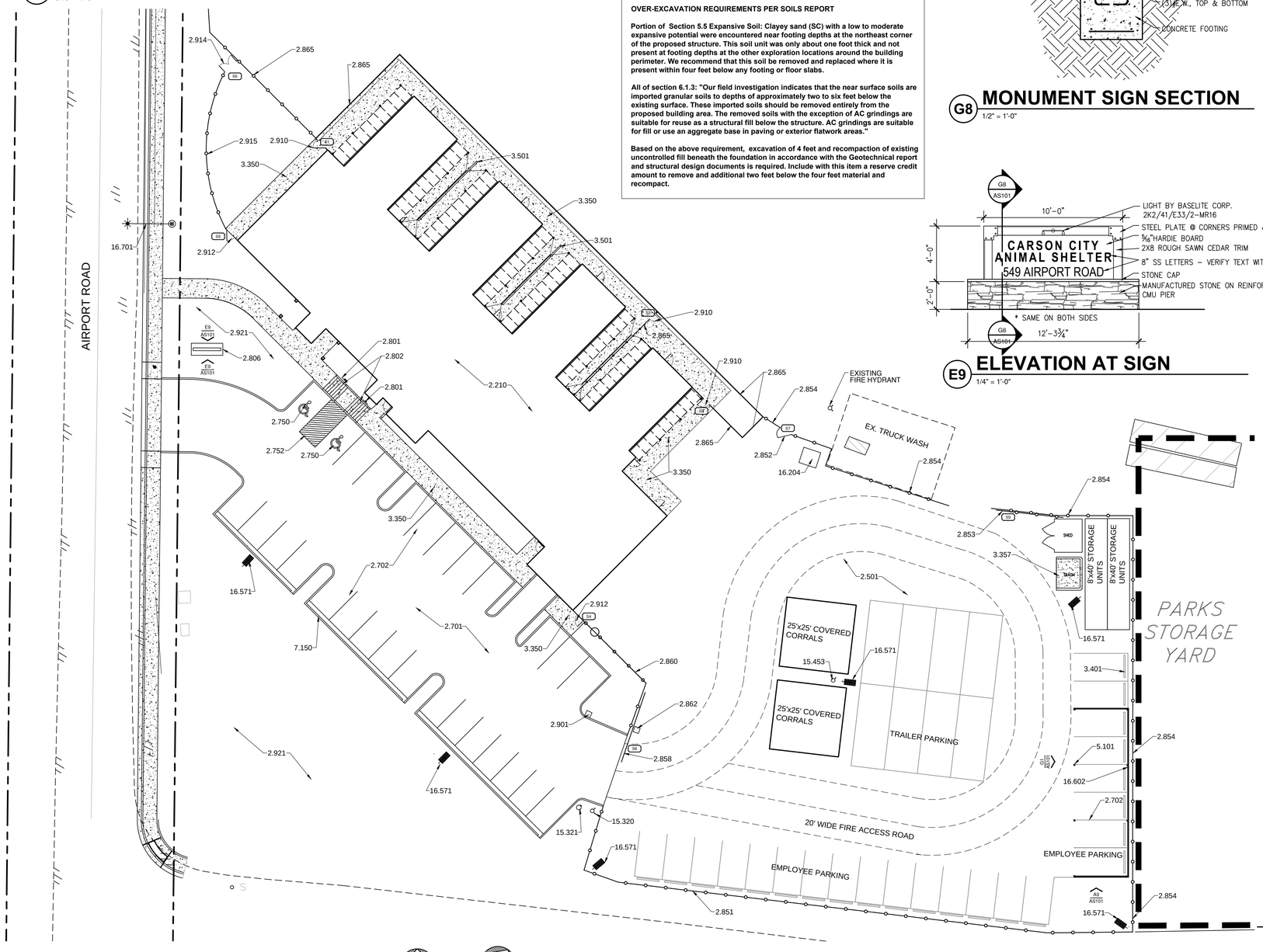
3/16" = 1'-0"

OVER-EXCAVATION REQUIREMENTS PER SOILS REPORT

Portion of Section 5.5 Expansive Soil: Clayey sand (SC) with a low to moderate expansive potential were encountered near footing depths at the northeast corner of the proposed structure. This soil unit was only about one foot thick and not present at footing depths at the other exploration locations around the building perimeter. We recommend that this soil be removed and replaced where it is present within four feet below any footing or floor slabs.

All of section 6.1.3: "Our field investigation indicates that the near surface soils are imported granular soils to depths of approximately two to six feet below the existing surface. These imported soils should be removed entirely from the proposed building area. The removed soils with the exception of AC grindings are suitable for reuse as a structural fill below the structure. AC grindings are suitable for fill or use an aggregate base in paving or exterior flatwork areas."

Based on the above requirement, excavation of 4 feet and recompaction of existing uncontrolled fill beneath the foundation in accordance with the Geotechnical report and structural design documents is required. Include with this item a reserve credit amount to remove and additional two feet below the four feet material and recompact.

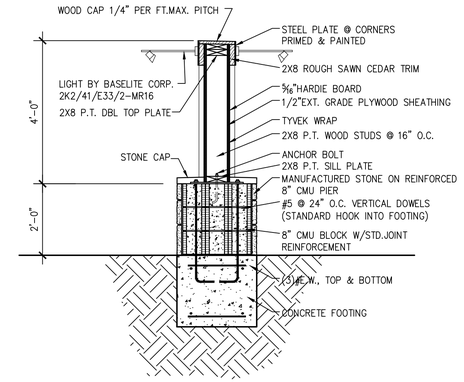


A1 ARCHITECTURAL SITE PLAN

1" = 20'-0"

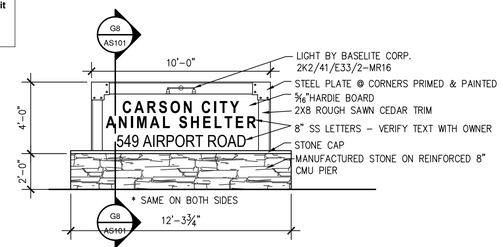
TRUE NORTH

PROJECT NORTH



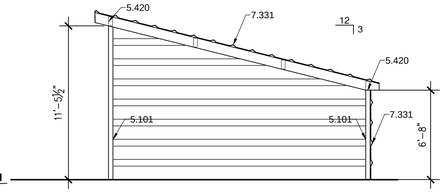
G8 MONUMENT SIGN SECTION

1/2" = 1'-0"



E9 ELEVATION AT SIGN

1/4" = 1'-0"



A9 CARPORT ELEVATION

3/16" = 1'-0"

GENERAL NOTES

A. **THIS IS NOT A SURVEY**. INFORMATION TAKEN FROM A SURVEY PREPARED BY BOWLING MAMOLA GROUP, DATED 5-18-12. *(INSERT SURVEYER'S JOB NUMBER, IF KNOWN)* REFER TO THAT SURVEY FOR ALL BOUNDRY AND EXISTING CONDITIONS.

REFERENCE KEYNOTES

DIVISION 01 - GENERAL REQUIREMENTS
1.005 - EXISTING STRUCTURE

DIVISION 02 - SITE CONSTRUCTION
2.210 - PROPOSED BUILDING LOCATION
2.501 - EXISTING SURFACE TO REMAIN
2.701 - ASPHALT PAVING
2.702 - PARKING STRIPES
2.750 - ADA ACCESSIBLE PARKING
2.752 - ADA ACCESS ISLE
2.801 - ADA PARKING SIGN
2.802 - ADA ACCESSIBLE RAMP
2.806 - MONUMENT SIGN: SEE DTLS C9 & G8/AS101
2.850 - CHAIN LINK FENCE
2.851 - EXISTING CHAIN LINK FENCE
2.852 - CHAIN LINK GATE - SEE GATE SCHEDULE SHEET A601
2.853 - RELOCATED CHAIN LINK SLIDING GATE
2.854 - RELOCATED CHAIN LINK FENCE
2.858 - ROLLING GATE: GUARDIAN STYLE, SEE SCHEDULE SHEET A601
2.860 - 7' TALL, GUARDIAN STYLE METAL FENCE
2.862 - GATE OPENER
2.865 - VINYL PRIVACY FENCE: 6' TALL
2.901 - GATE/ CARD READER, ON PEDESTAL
2.910 - VINYL GATE: 4' WIDE - SEE GATE SCHEDULE SHEET A601
2.912 - FABRICATED GATE: 4' WIDE - SEE GATE SCHEDULE SHEET A601
2.914 FABRICATED GATE 6' WIDE: SEE GATE SCHEDULE, SHEET A601
2.915 - 6' TALL MAJESTIC STYLE METAL FENCE w/ PUPPY PANELS
2.921 - LANDSCAPE AREA

DIVISION 03 - CONCRETE
3.350 - CONCRETE SIDEWALK
3.357 - CONCRETE PAD WITH RAISED CURB, 3 SDS
3.401 - CONCRETE WHEEL STOP
3.501 - C.M.U. WALL, 3'-4" AFF

DIVISION 05 - METALS
5.101 - STEEL COLUMN - SEE A8/A304
5.110 - STEEL PURLIN - SEE A8/A304
5.420 - STEEL BEAM - SEE A8/A304

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
7.150 - CURB AND GUTTER
7.151 - ROOF GUTTER
7.331 - R-PANEL METAL PANEL SYSTEM

DIVISION 15 - MECHANICAL
15.320 - FIRE HYDRANT
15.321 - FIRE DEPARTMENT CONNECTION
15.453 - YARD HYDRANT

DIVISION 16 - ELECTRICAL
16.204 - ELECTRICAL TRANSFORMER
16.571 - PARKING LOT LIGHT POLE
16.602 CONDUIT FOR POWER
16.701 - NEW STREET LIGHT POWER, OFF BLDG

901 Lamberton Pl. NE
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Phone: (505) 858-0100
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Email: info@bdaarc.com

BDA

WAYNE V. URIAS REGISTERED No. 3212 ARCHITECT STATE OF NEVADA

CARSON CITY ANIMAL SHELTER
549 Airport Road
Carson City, Nevada 89701
City of Carson City

ARCHITECTURAL SITE PLAN

REVISION:	REV.#	DATE	COMMENTS
REVISION:	-		
REVISION:	-		
REVISION:	-		

REVIEWS

INITIALS	
-	BDA DSGN. REV.
-	BDA TECH REV.

CCAS

PROJECT NO.: 1107
DRAWN: DG
DATE: 3/17/15

AS101

- OF -

Save Date: March 17, 2015 - 10:51 AM - Julie
Plot Date: March 17, 2015 - 11:38 AM
Drawing Name: G:\Archive\2011\1107-Carson City Animal Services\BDA\DWGS\CDs\Carson City\Sheets\1107 AS101 Architectural Site Plan.dwg

REFERENCE KEYNOTES

DIVISION 06 - WOOD AND PLASTICS

6.101 - WOOD FRAMING

6.114 - DOUBLE TOP PLATE

6.141 - SHEATHING - SEE STRUCTURAL

6.160 - WOOD TRUSS - SEE STRUCTURAL

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

7.101 - WEATHER RESISTANT BARRIER

7.104 - ICE AND WATER SHIELD

7.151 - ROOF GUTTER

7.204 - R-38 BATT INSULATION

7.229 - 2 1/2" RIGID INSULATION

7.230 - CORAVENT

7.331 - METAL ROOF PANEL SYSTEM

7.371 - 1X FASCIA

7.376 - VENTED HARDIE BOARD SOFFIT

7.402 - BOARD AND BATTEN SIDING

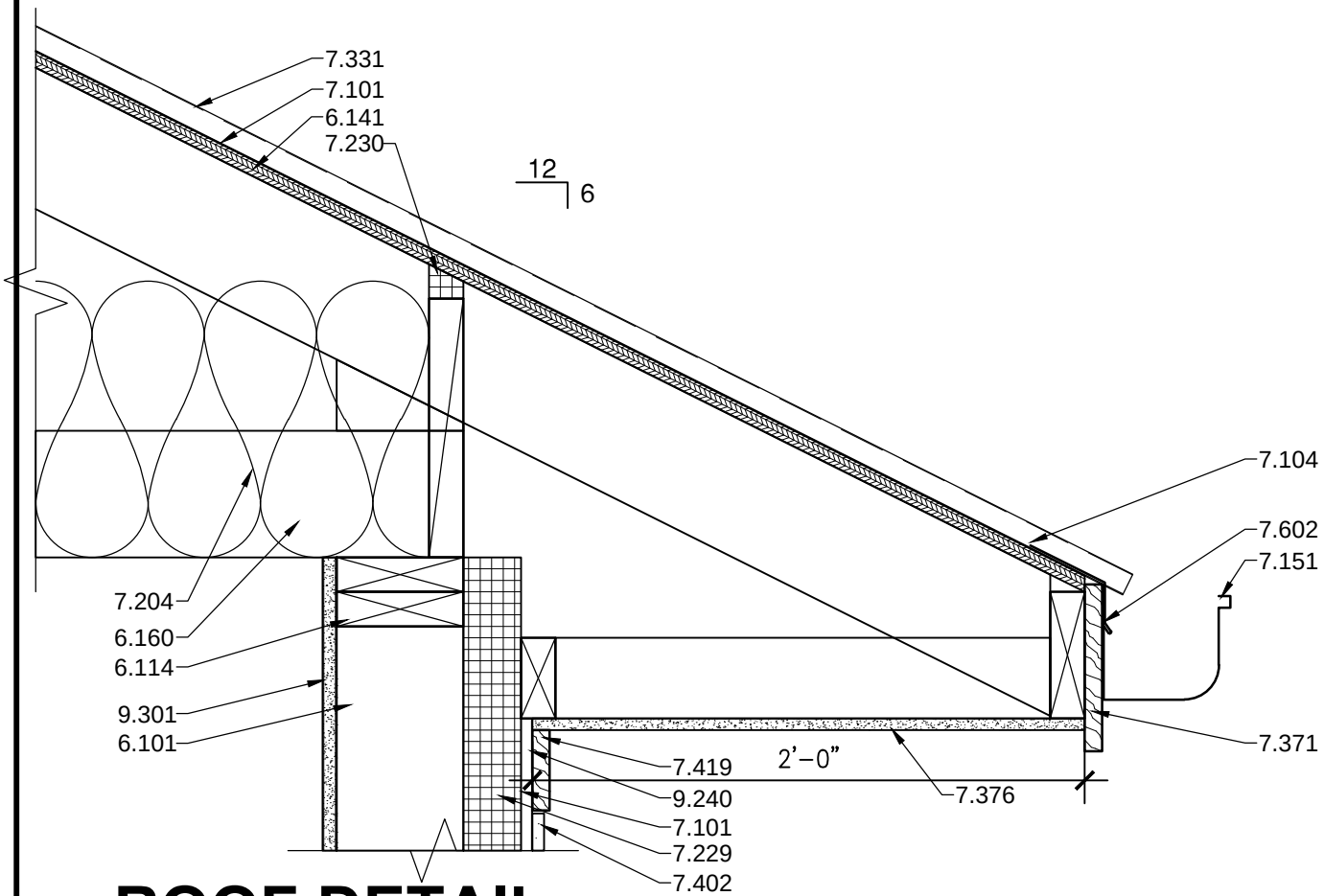
7.419 - HARDI BOARD TRIM BOARD

7.602 - METAL DRIP EDGE FLASHING

DIVISION 09 - FINISHES

9.240 - 1/2" RESILIENT FURRING CHANNEL

9.301 - 5/8" GYPSUM BOARD



A5 ROOF DETAIL

1 1/2"=1'-0"

BDA Architecture, P.C.
Gladysz & Usiak Architecture, LLC
901 Lamberton Pl. NE
Albuquerque, NM 87107
Phone: (505) 858-0180
Fax: (505) 858-0111
Email: info@bdaarc.com

CARSON CITY ANIMAL SHELTER

549 Airport Road
Carson City, Nevada 89701
City of Carson City

ROOF AND WALL DETAILS

1X4 HARDIETRIM BOARD DETAIL

CCAS
PROJECT NO.: 1107
DRAWN:
REVIEWED:
DATE: 3/16/2015

SK2/A507

TECHNICAL SPECIFICATIONS

SECTION 15010 – BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. The General and Special Conditions of the Contract shall apply to this section.

B. This section, 15010, shall be part of each Mechanical section.

1.02 CODES AND STANDARDS

A. All work shall be in accordance with applicable state and local codes. All work shall comply with the rules and recommendations of the National Fire Protection Association, all requirements of local utility companies and the State Fire Marshal. These codes, rules, recommendations and requirements shall take precedence if the drawings and specifications are not in conformance therewith, except that where the drawings and specifications exceed minimum code requirements, the drawings and specifications shall take precedence.

1.03 PERMITS, LICENSES AND FEES

A. The Contractor shall familiarize themselves with all requirements as to permits, licenses, fees, codes and ordinances and arrange to comply with them. All permits, licenses, fees and inspections required for the work under this Contract shall be obtained and paid for by the Contractor unless otherwise specified. The required permits shall be initiated within thirty (30) days after contracts have been awarded.

1.04 DATE AND MEASUREMENTS

A. The data given herein and on the drawings is as exact as could be secured. Their absolute locations, measurements, levels, etc., shall be verified by the Contractor at the site and the Contractor shall satisfactorily adapt their work to the actual conditions at the buildings.

1.05 COORDINATION OF WORK

A. The Contractor shall plan all work so that it proceeds with a minimum of interference between trades. It shall also be the responsibility of the Contractor to provide all openings required in the building construction for the installation of mechanical work. Provisions shall be made for all special frames, openings and pipe sleeves as required. The Contractor shall do all extra cutting and patching made necessary by their failure to properly direct such at the correct time.

1.06 QUALIFICATIONS OF INSTALLERS

A. All work shall be performed by workers skilled in the respective trade required by each part of the work. Helpers and apprentices used for any part of the work shall be under the full supervision of a thoroughly trained and skilled mechanic of the trade required for that part of the work. No allowance will be made for lack of skill in the acceptance or rejection of any work.

1.07 QUALITY OF WORK

A. All work shall be of the best quality, free from defects in workmanship, materials and performance.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for which only one manufacturer's name, model or catalog number is given, shall be used as specified. Materials and equipment specified to be one of two or more equally acceptable makes or types may be of any one of the makes or types mentioned, but shall be of one make or type throughout the project. Materials and equipment specified to be of a certain make or type, or equal, shall be of the make and type specified, or alternate materials and equipment which have been approved by the Architect/Engineer. Unless otherwise specified or shown, all materials shall be new and previously unused.

2.02 SUBSTITUTIONS

A. The Architect/Engineer shall be the sole and final judge as to the suitability of items substituted for those specified. The entire cost of all changes of any type due to substitutions for materials specified shall be borne by the Contractor at no extra cost to the Owner.

2.03 EQUIPMENT FINISH

A. The exposed finished surfaces of most mechanical equipment is finished at the factory and great care shall be exercised by the Contractor so as not to damage the original finish during the installation of the equipment. If the factory finish is damaged during construction and installation, the equipment shall be refinished in equivalent factory finish in every respect including color, texture, and smoothness of texture.

PART 3 – EXECUTION

3.01 TESTS AND ADJUSTMENTS

A. After completion of the work, but before final payment is made, the Contractor shall run a test over a sufficient period of time to prove the proper capacity and performance of all apparatus, etc., and of the systems as a whole.

B. All piping shall be pressure tested at 100 psi or twice the operating pressure, whichever is greater. If found that any portion of the system does not function, the Contractor shall make corrections as directed.

C. All controls and safety devices shall be thoroughly checked to assure proper operation and protection.

D. All valves and specialties shall be adjusted to operate smoothly and without binding or leaking. All vents shall be tested. New operating parts shall be installed where ordinary adjustments fail to remedy faulty operation.

3.02 OPERATING INSTRUCTIONS

A. After all tests and adjustments are completed, the Contractor shall give complete operating and maintenance instructions to the Owner's operating personnel. The Operating and Maintenance Manual shall be used as the basis of instructions.

3.03 OPERATING AND MAINTENANCE MANUAL

A. The Contractor shall furnish an Operating and Maintenance Manual to the Owner after all tests and adjustments have been completed. Final payment will not be made until this manual has been approved by the Architect/Engineer and delivered to the Owner. The manual shall include:

1. Startup and Shutdown Procedure: A written description of the procedure for starting up and shutting down each mechanical system shall be included in the manual. This description shall include motors to start, valves to open, etc., in proper sequence and location of switches, starters, push buttons and valves.
2. Seasonal Changeover Procedure: A written description of the procedures necessary for seasonal changeover from heating to cooling and vice-versa shall be included in the manual.
3. Maintenance Procedure: A written description of all procedures necessary for proper maintenance of all heating and cooling equipment shall be included in the manual. Listings shall include required

   time interval between maintenance procedures. This shall include recommendations for water treatment procedures.
4. Valve List: A list of all valves with the number and function of each valve shall be included in the manual.
5. V-Belt and Filter List: A list of all V-belts and filters with sizes, types and quantities required by each piece of equipment shall be included in the manual.
6. Manufacturer's Manuals and Parts List: Operating and maintenance manuals and parts lists furnished by equipment manufacturers shall be included in the manual.
7. Shop Drawings: One copy of each approved shop drawing shall be included in the manual.
8. Index: A complete index shall be included at the front of the manual.
9. Binder: All of the above-described items shall be assembled in a three-ring binder, with a hard cover and durable cloth or plastic finish.

3.04 GUARANTEE

A. The Contractor shall guarantee that all mechanical systems shall be free from defects in workmanship, materials and performance to specified capacities and, that if such defects shall appear during a period of one year from date of final acceptance, they will remedy such defects to the satisfaction of the Architect/Engineer at no extra cost to the Owner, within a reasonable time.

3.05 CLEANING

A. The Contractor shall maintain all areas free from hazardous or obstructive rubbish and debris due to installation of the mechanical work during construction. When the mechanical systems have been installed, the Contractor shall remove all rubbish and debris resulting from their work from the building and site and remove all paint, plaster and accumulated dirt from all mechanical equipment, fixtures and piping.

3.06 AS-BUILT DRAWINGS

A. This Contractor shall prepare as-built drawings for the various component portions of the mechanical installations. These drawings shall be furnished to the Architect/Engineer after completion of the work. These drawings shall be prepared by marking up a set of contract drawings with red pencil to show changes made during construction after the various installations have been completed.

3.07 SHOP DRAWINGS

A. Shop drawings and/or descriptive literature shall be submitted in accordance with these Specifications for the following listed equipment and materials:

Paragraph Number	Description	Date Submitted	Date Reviewed	Date Resubmitted
15050				
Part 2	Valves			
15250				
Part 2	Mechanical Insulation			
15400				
Part 2	Water Meter			
Part 2	Wall Hydrants			
Part 2	Street Washer Hydrants			
Part 2	Hose Bibbs			
Part 2	Drains			
Part 2	Backflow Preventer			
Part 2	Gas-Fired Hot Water Heaters			
Part 2	Hot Water Circulating Pump			
Part 2	Plumbing Fixtures			
Part 3	Sanitary Drainage Pipe Joints			
15880				
Part 2	Heating and Air Conditioning Unit			
Part 2	Roof Exhaust Fans-Centrifugal Type			
Part 2	Ceiling Type Exhaust Fans			
Part 2	Registers			
Part 2	Grilles			
Part 2	Diffusers			
Part 2	Fire Dampers			
Part 2	Smoke Detectors			
15990				
Part 1	Submittals			
Part 3	Submittal of Reports			

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 15050 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specifications.

B. This section, 15050, shall be a part of each Mechanical section.

PART 2 – PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Steel Pipe: Shall be Schedule 40 welded or seamless steel pipe conforming to ASTM Specification A-120 and A-53 Grade B. Steel pipe shall be black or galvanized as specified for the application.

B. Gray Cast-Iron Threaded Fittings: Shall be gray cast-iron, free of sandholes and imperfections, with clean ANSI standard taper pipe threads. The material used in the manufacturing of the fittings shall conform to ASTM A-126; the fittings shall be manufactured according to ANSI Standard B16.4, Class 125 and Federal Specification SS-P-501. The taper pipe threads shall conform to ANSI Standard B2.1. Fittings shall be black or hot-dip galvanized as specified for the application.

C. Malleable-Iron Threaded Fittings: Shall be malleable-iron, free of sandholes and imperfections, with clean ANSI standard taper pipe threads. The material used in the manufacturing of the fittings shall conform to ASTM A-197; the fittings shall be manufactured according to ANSI Standard B16.3, Class 150 and Federal Specification WW-P-521. The taper pipe threads shall conform to ANSI Standard B2.1. Fittings shall be black or hot-dip galvanized as specified for the application.

D. Cast-Iron Drainage Fittings: Shall be gray cast-iron, free of sandholes and imperfections, with clean ANSI standard taper pipe threads. The fitting shall be manufactured according to ANSI Standard B16.12 and Federal Specification WW-P-491. Fittings having openings at right angles shall have pitched threads to provide a ¼" per foot pitch drainage.

E. Welding Fittings: Shall be steel, butt weld fittings complying with ANSI Standard B16.9. Tee connections shall be made with standard tee fittings or BONNEY "Weld-O-Lets."

2.02 CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and fittings shall be gray cast-iron soil pipe and fittings that comply with Federal Specification WW-P-401, ANSI Standard A112.51 or Commercial Standard CS 188. Joints shall be hub-and-spigot for elastomeric compression type gaskets complying to ASTM A 74 for below-grade service or hubless for "No'Hub" elastomeric gaskets with stainless steel clamps complying with ASTM Standard C564 and the Cast Iron Pipe Institutes Standard 301 for above-grade service.

2.03 COPPER PIPE AND FITTINGS

A. Copper Water Tube: Shall comply with Federal Specification WW-T-799 and ASTM Specification B88. Weight shall be K or L and temper shall be hard-drawn or annealed as specified for the application.

B. Copper Water Tube Fittings: Pressure fittings shall be wrought-copper solder joint complying with ANSI Standard B16.22, cast copper alloy solder joint complying with ANSI Standard B16.18, or cast-copper alloy flared tube complying with ANSI Standard B16.26 as required for the application.

C. Copper Flange Fittings: Cast-copper alloy flanges and flange fittings shall be Class 150 in accordance with Federal Specification WW-F-406 and ANSI Standard B16.24 or Class 125 meeting ASME standard.

D. Cast Bronze Threaded Fittings: Shall comply with ANSI B16.15.

E. Copper Drainage, Waste and Vent Tubing: Shall comply with ASTM Specification B306.

F. Copper Drainage, Waste and Vent Tubing Fittings: Shall be wrought-copper drainage fittings complying with ANSI Standard B16.29 or cast copper alloy solder joint drainage fittings complying with ANSI Standard B16.23. Fittings shall have "DMV" stamped into the fitting.

2.04 PVC WATER PIPE AND FITTINGS

A. PVC Water Pipe and Fittings 3" and Smaller:

1. Pipe: Shall be rigid, unplasticized, polyvinyl chloride (PVC) Type I Schedule 40 in accordance with ASTM D1785
2. Fittings: Fittings shall be PVC Schedule 40 with cemented (solvent welded) joint slip socket and shall be in accordance with ASTM D2466.

B. PVC Sewer Pipe and Fittings 4" and Smaller:

1. Pipe: PVC pipe shall be Schedule 40, Type I with plain ends conforming to ASTM D2665.
2. Fittings: Fittings shall be PVC Schedule 40 with cemented (solvent welded) joint slip socket an shall be in accordance with ASTM D2665 an D3311.

2.05 VALVES

A. Valves shall be furnished and installed wherever shown or specified, using adapters where required. All removable or replaceable equipment shall have shutoff valves. Ball, butterfly, gate, globe and swing check valves shall be manufactured by Grinnell, Milwaukee, Nibco, Stockham, or approved equal. All valves 2-1/2" and larger shall be flanged. All valves shall be same size as upstream pipe, unless otherwise indicated.

1. Ball Valves, 1" and Smaller: Rated for 125 psi saturated steam pressure, 400 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 584 Alloy 844, standard port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide threaded ends for all ball valves. Solder ends shall be unacceptable. Valve shall be Grinnell valve, or approved equal.
2. Ball Valves, 1-1/4" to 2": Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; three-piece construction; with bronze body conforming to ASTM B 584 Alloy 844, full port, chrome-plated bronze ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide threaded ends for all ball valves. Solder ends shall be unacceptable. Valve shall be Grinnell valve, or approved equal.

2.06 STRAINERS

A. Furnish and install strainers where shown on the drawings and details. Strainers shall be Hoffman Series, or equal, with cast iron or bronze body and brass or stainless steel perforated screens. Sizes ½" through 2" for Copper Piping Systems: Y pattern, bronze body,
B. 250 lb screwed.

2.07 UNIONS

A. Unions shall be provided at each screwed type valve and at each piece of equipment having screwed connections.

1. Unions in steel pipe shall be heavy-duty, malleable, screwed-type, with brass-to-iron ground joints.

2. Unions in copper tube shall be copper with solder connections and copper-to-copper ground joints. Nibco, or equal.
3. Dielectric unions, EPCO, or equal, shall be provided at all connections between ferrous and non-ferrous piping, and at all connections between piping and equipment where one is ferrous and the other non-ferrous.

2.08 PAINT

A. Paint shall be as specified in Section 09900 – Painting.

PART 3 – EXECUTION

3.01 EXCAVATION

A. Piping trenches shall be accurately graded to provide uniform support on undisturbed soil for piping. Excavations for joints shall be made after grading trench bottom and shall be as small as possible. Excavations made too deep shall be filled with fill sand and compacted to density of surrounding undisturbed soil. Unstable soils not suitable for proper pipe support shall be removed and replaced with suitable materials as directed.

B. Care shall be taken to avoid injury to foundations or footings. Sheeting, shoring and bracing shall be provided where necessary in deep trenches or in unstable soils. Necessary grading shall be done to prevent surface water from entering trenches or excavations. Water accumulating in trenches or excavations shall be removed as soon as possible. The last 4" depth of all trenches shall be excavated by hand to fit the pipe in the grade.

3.02 BACKFILLING

A. After the installation has been tested and approved, trenches and excavations shall be backfilled in 6" layers of earth, free from clods and stones, thoroughly tamped to a density equal to adjacent material. Where settlement occurs, excavations or trenches shall be reopened, refilled and compacted to a density equal to adjacent material.

B. Pavement or walk cuts shall be repaved with material identical to surfacing material removed in accordance with local codes or ordinances and as directed by the Architect/Engineer. Paving cuts in concrete shall be made with a concrete saw in straight lines.

3.03 EQUIPMENT INSTALLATION

A. All motors and bearings shall be covered with watertight and dustproof covers during the construction period.

B. All piping connection to equipment shall be made with shutoff valves and unions or flanges to permit dismantling. Flanges and unions shall also be installed in the piping systems to permit disassembly consistent with good installation practice.

C. All belt drives, flexible couplings and other exposed rotating or reciprocating parts shall be covered with approved safety covers. Covers shall be permanent type and easily removable.

D. Each pump shall have a check valve and gate valve in the discharge line.

E. All piping connections to rotating or reciprocating equipment shall be made with flexible piping connections. All floor-mounted equipment items shall be installed on a concrete base 3-1/2" above the floor. See paragraph on Concrete. All floor-mounted rotating or reciprocating equipment shall be mounted on vibration isolation pads or springs designed for that specific purpose.

3.04 PIPING INSTALLATION

A. All piping shall be securely supported by means of pipe hangers. Due provision shall be made for expansion of piping. Pipes shall be securely anchored where necessary to properly distribute stresses. Pipe hangers shall be spaced as follows:

1.	Cast-Iron Pipe:	One hanger to each hub.	
2.	Steel or Copper Pipe:	1-1/4" or smaller	8' on centers
		1-1/2" or 2"	10' on centers
		2-1/2" or larger	12' on centers

B. Pipe hangers shall be of the split-loop type with hanger rod, or of the trapeze type with horizontal angle iron "U" bolts and hanger rods. Split-loop type hangers shall be steel or cast iron for uninsulated steel or cast-iron pipe, and copper plated for uninsulated copper pipe. Pipe hangers for insulated pipe shall have attached metal insulation shield. Hanger rods shall be 3/8" for pipes up through 2", ½" for pipes 2-1/2" through 3-1/2", 5/8" for 4" and 5" pipes, ¾" for 6" pipes, and 7/8" for 8" pipes and larger. Rods for trapeze hangers shall be 7/8".

C. Approved insulating blocking shall be placed between sheet metal jacket and bottom of pipe where jacket alone cannot prevent crushing. Insulation jacket or vapor barrier shall be sealed after installation blocking. All insulation shall extend through wall or floor sleeves. Cutting of openings and installation of frames through walls and surfaces shall be done in a neat, workmanlike manner. Openings shall be cut only as large as required for the installation and sleeves shall be grouted in place. Surfaces around openings shall be left smooth.

D. Insulating couplings, EPCO or equal, shall be installed in all connections between piping systems of dissimilar materials and connections between piping and equipment of dissimilar materials.

E. Where piping connections to pumps are made through flexible connections, the piping shall be securely anchored against longitudinal thrust along axis of pipe to remove all stress from flexible connections.

F. Pipe rollers and special pipe supports shall be as shown on the drawings.

G. All openings in pipes shall be kept closed during the progress of the work.

H. If any existing water, gas or other pipes and appurtenances are encountered, which interfere with the proper installation of new work and will not be in use after new work is finished, this Contractor shall close such pipe in a proper manner and, if necessary, shall move or remove the pipes as directed by the Architect/Engineer.

3.05 ACCESS

A. All motors, valves, control devices, specialties, etc. shall be located so as to provide for easy access for operation, repair and maintenance. If concealed, access doors shall be provided. Access doors for concealed valves, control devices and other specialties shall be of steel, 18" x 18", complete with steel frame, as manufactured by Milcor Division, Inland Steel Company, or equal. Frames shall be designed for masonry, plaster or drywall as required and shall be fire rated to match the wall/ceiling assembly on which it is installed.

3.06 EQUIPMENT IDENTIFICATION

A. Each piece of equipment shall have a plastic or metal identification plate securely fastened to the equipment in a position to be easily read. Plate shall have name and mark shown on the

drawings such as “Air Handling Unit AH-1.” This name and mark shall be used in referring to items of equipment in the Operating and Maintenance Manual.

3.07 VALVE DESIGNATION

A. A stamped brass plate, securely fastened to each valve, shall be furnished and installed on all valves. Each plate shall have a number engraved on it. A list of all valves with the number and function of each valve shall be included in the Operating and Maintenance Manual.

3.08 PIPE CODING

A. Mechanical Contractor shall code all piping which is accessible for maintenance operations, except piping in finished spaces, with Setmark semi-rigid plastic (not pressure-sensitive) identification markers as manufactured by Seton Name Plate Corporation, New Haven, Connecticut 06506, or equal.

B. Direction of flow arrows shall be included on each marker.

C. In Conformance with "Scheme for the Identification of Piping Systems," ANSI A13.1, 1981, each marker shall show:

1. Approved color-coded background;
2. Proper color of legend in relation to background color;
3. Approved legend letter size, and
4. Approved marker length.

D. Setmark Type SNA markers shall be used on diameters ¾" through 5".

E. Setmark Type STR markers shall be used on diameters 6" or larger.

F. For pipes under ¾" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed ¾" high black-filled letters above ½" black-filled numbers shall be fastened securely at specified locations.

G. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve (except on plumbing fixtures).
2. At each branch and riser take-off.
3. At each pipe passage through wall, floor and ceiling construction.
4. At each pipe passage to underground.
5. On all horizontal pipe runs – marked every 25 feet.

3.09 LUBRICATION

A. The Contractor shall be required to provide all lubrication for the operation of all equipment until acceptance. A chart listing each piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication shall be included in the Operation and Maintenance Manual.

B. The Contractor shall be required to run in all bearings and, after they are run in, shall drain and flush bearings and refill with a new oil change.

3.10 CONCRETE WORK

A. Furnish and install all concrete work under the Mechanical Contract as shown on the plans. Sizes as given are applicable to basic specification items. If substitute items are used, this Contractor shall be responsible for the revision of sizes and depths and shall give the information to the General Contractor for any revised sizes of floor openings.

B. Each major item of equipment in mechanical equipment rooms shall have a concrete pad 3-1/2" above the floor.

C. Concrete: Shall contain not less than five (5) sacks of cement per cubic yard. Strength of concrete shall not be less than 3,000 psi at 28 days.

D. Reinforcing Steel: All bars shall be deformed, billet, intermediate grade, in accordance with ASTM Specification A15-30. Welds in wire fabric shall be of sufficient strength that they will not be broken during placement.

E. Placing: No concrete can be placed until the Architect/Engineer has approved the depth and character of the foundations, the placement of the reinforcing steel, forms or shoring, etc. The Contractor shall give the Architect/Engineer 24-hours notice before placing concrete. Concrete can be deposited under water only with the written consent of, and under the supervision of, the Architect/Engineer. All concrete shall be vibrated, using mechanical vibrators, by skilled workmen paying particular attention to corners and faces of concrete against forms and joints. All concrete work will be performed by skilled tradesman in that particular field of work. No concrete will be poured below 40º F. unless proper provisions are made for heating, as directed by the Architect/Engineer. All concrete will be cured by covering with burlap and keeping cover saturated for seven (7) days after placement.

F. Finish: All foundations shall be finished by striking off to true plane with a template, the surface sprinkled with a mixture of one part dry cement and one part sand, and then floated to an even surface. All vertical faces shall be rubbed with a carborundum brick and a neat cement grout to provide a smooth surface after removing forms. Forms shall be removed within 24 hours to develop bond between grout and concrete.

G. Forms: All forms shall be of wood so designed and constructed to hold the concrete true to line without sagging, bulging or distorting.

H. Installation: Concrete work shall be installed straight, level and true with finish consistent with appearance of surrounding work. Edges shall be chamfered where required to prevent chipping. Pads of foundations on grade shall be installed with ½" approved expansion joint material all around. Pads or foundations on slabs shall be doweled to slab. Equipment requiring special foundations shall have foundations installed as recommended by the equipment manufacturer.

1. Anchor bolts shall be set in pipe sleeves large enough to permit adjustment. Bolts may be anchored in place with lead or sulfur.
2. Commercially available, ready-mixed concrete, of type approved by the Architect/Engineer, may be used for the required work.

3.11 FIXTURES AND EQUIPMENT FURNISHED BY OTHERS

A. Where the drawings indicate fixtures and equipment that are to be furnished and installed by others, and that require connections to the mechanical systems, the Mechanical Contractor shall furnish and install all rough-in of piping or ducts, all necessary traps, stops and supplies, and shall make final connections to the fixtures and equipment. Rough-in locations shall be determined from the equipment itself or from the equipment manufacturer's shop drawings.

END OF SECTION

SECTION 15250 – MECHANICAL INSULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Section 15050 – Basic Mechanical Materials and Methods.

B. Refer to Section 15880 – Air Distribution, for acoustic duct liner.

1.03 WORK INCLUDED

A. The work under this section shall include furnishing and installing all insulation required for the mechanical systems for this project except acoustic duct liner which is included in Section 15880 – Air Distribution.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Insulation and materials shall be Owens-Corning, Knauf, Mansville, Certainteed or Armstrong. Special materials shall be of manufacturer indicated or equal.

B. The insulation and materials specified shall be furnished to the job bearing the manufacturer's label.

2.02 MATERIALS LIST

A. The Contractor shall submit a complete materials list for the project.

2.03 FIBERGLASS PIPE INSULATION

A. Fiberglass pipe insulation shall be fibrous glass wool accurately molded to conform to the outside diameter of the pipe. Insulation shall be suitable for use on either hot or cold water pipes.

2.04 ALL-SERVICE JACKET

A. All-service jacket for pipe insulation shall have a white kraft paper outer surface bonded to .35 mil aluminum foil and reinforced with fiberglass yarn, with laps for longitudinal joints and matching tape for end joints.

2.05 ALUMINUM JACKET

A. Metal jacketing for exterior pipe insulation shall be Manville Metal-Lok ML, or approved equal, polished aluminum of 0.016" thickness with banding, adhesives, sealers, etc., as recommended by the insulation manufacturer.

2.06 FLEXIBLE ELASTOMERIC INSULATION

A. Flexible elastomeric insulation shall be fire retardant, foamed plastic accurately molded to conform to the outside diameter of the pipe or in flat sheets for ductwork. Insulation shall have a density of 6.0 lbs per cubic foot and a K-factor of 0.28 BTUH-IN/SQ FT-DEG F.

2.07 VALVE AND PIPE FITTING INSULATION

A. Valve and pipe fitting insulation shall be Zeston premolded, one-piece PVC insulated fittings, or equal.

2.08 FLEXIBLE DUCT WRAP INSULATION AND VAPOR BARRIER

A. External wrap insulation for metal ducts shall be flexible glass fiber blanket. Density shall be ¾ lb per cubic foot with a thickness of 1-1/2". The out of package R-value shall not be less than 5.8 and an installed R-value of not less than 4.4 (assuming a maximum of 25% compression during installation) at 75º F.

B. The duct wrap insulation shall satisfy the fire rating requirements listed below and also satisfy NFPA 90A and 90B standards. The insulation shall have a moisture absorption of less than 0.2% by volume, shall not accelerate corrosivity to steel, copper, or aluminum, and shall not promote growth of fungi or bacteria.

C. The duct wrap insulation shall comply with Federal Specifications HH-I-558B Form B, Type I Class 6 for temperatures up to and including 350º F.

D. Vapor Barrier: If the duct is used for cooling applications, then the duct wrap insulation shall have FSK aluminum foil facing with a maximum vapor permeance of 0.02 perms. The faced duct wrap shall be rated to +250º F. The FSK aluminum facing shall comply with Federal Specification HH-B-100B type II for medium vapor transmission and moderate puncture resistance.

2.09 OUTDOOR DUCT WRAP INSULATION

A. External wrap insulation for metal ducts shall be 1-1/2" thick rigid polystyrene board. Corrugated aluminum sheeting .015" thick shall be wrapped around the insulation and sealed watertight.

2.10 FIRE RATINGS

A. All insulation shall have composite (insulation, jacket or facing and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and Underwriters Laboratories, Inc., 723 not exceeding Flame Spread 25 and Smoke Developed 50.

B. Accessories such as adhesives, mastics, cements, tapes and asbestos cloth for fittings shall have the same component ratings as listed above.

C. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

D. The Insulation Contractor shall certify in writing, prior to installation, that all products to be used will meet the above criteria.

PART 3 – EXECUTION

3.01 GENERAL

A. Insulation shall be applied only by mechanics skilled at such work. The appearance of the finished work shall be of equal importance with its mechanical correctness and efficiency. Insulation for heating surfaces and piping shall not be applied until such times as those

surfaces are sufficiently heated to properly dry out the insulation. Insulation shall not be applied until the system is tested and approved as required.

B. All portions of the covering at joints and fittings shall be vapor sealed on cold piping (domestic cold water, storm drainage, refrigerant suction, chilled water).

C. Insulation shall be continuous through all walls, floors and ceilings unless otherwise specified, shown or approved.

D. Where insulation is to be painted, all surfaces shall be properly prepared to receive paint.

E. Unions, flanges and valves shall be insulated as specified for the associated piping system.

3.02 PIPE INSULATION

A. Pipe insulation shall be as scheduled below:

System	Location	Thickness
Cold water	All piping	1" Fiberglass Pipe Insulation All Service Jacket
Domestic HW & HW recirc.	All piping	2" Fiberglass Pipe Insulation All Service Jacket

B. Fiberglass pipe insulation shall be applied over clean, dry surfaces with ends firmly butted together. Longitudinal jacket laps shall be stapled on hot lines and sealed with vapor barrier adhesive on cold lines. Joints on hot lines shall be covered using tape fastened with staples, and cold lines shall be covered with vapor barrier tape fastened with vapor barrier lap adhesive.

C. Flexible Tubing Insulation: Cut seams and mitered joints in flexible insulation shall be sealed with vapor resistant adhesive.

D. Pipe hangers shall be installed around the outside of the insulation and insulation shall be protected against crushing by sheet metal jacket of proper area and weight. Approved insulating blocking shall be placed between sheet metal jacket and bottom of pipe to prevent crushing of insulation on piping 2-1/2" and larger. Insulation jacket shall be sealed after installing blocking.

3.03 VALVE AND PIPE FITTING INSULATION

A. Fittings for Fiberglass Insulated Pipe:

1. Valves and fittings shall be insulated with pre-cut fiberglass and covered with Zeston, or equal, pre-molded, one-piece PVC insulated fittings covers. Fittings on cold water, chilled water and storm drainage piping shall have all edges sealed with Zeston adhesive and wrapped with Zeston vapor barrier tape. Insulated fittings shall be installed according to the manufacturer's recommendations.

2. Concealed valves and fittings shall be insulated with Zeston, or equal, fittings or shall be insulated as specified below:
   a. Valves and fittings 2" and smaller shall be wrapped with strips of glass fiber blanket insulation secured with twine to a thickness approximately 1/8" less than the adjacent pipe insulation. The valves and fittings shall then be coated with vapor barrier mastic to provide a smooth finish, flush with the adjacent pipe insulation and a wrapping of polyvinyl chloride tape with a minimum 2" overlap onto adjacent pipe insulation.
   b. Valves and fittings 2-1/2" and larger shall be insulated with pre-molded fiberglass fitting covers or cut segments of pipe insulation wired in place and coated with vapor barrier mastic and polyvinyl chloride tape with a minimum 2" overlap onto adjacent pipe insulation.

B. Fittings for Flexible Tubing Insulation: Insulation for valves and fittings of piping insulated with flexible tubing insulation shall be insulated with the same materials as the pipe insulation cut into segments and sections as required and sealed with vapor resistant adhesive.

3.04 DUCT INSULATION

A. All square and rectangular ductwork shall have 1" acoustic liner unless otherwise noted on the drawings and as specified in Section 15880 – Air Distribution for acoustic duct liner.

B. All ducts not having insulating duct liner shall have external wrap insulation as specified under "Products" of this Specification section. Ducts requiring external wrap insulation are as specified below:

System	Location
Supply Air Systems	All round & oval ducts

Ducts used for cooling shall have a vapor barrier jacket.

C. Installation: Install insulation products in accordance with the manufacturer's written instructions and in accordance with the recognized industry practices to ensure that the insulation serves its intended purpose. Install insulation materials with smooth and even surfaces. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor barrier on ductwork and insulation and protect it to prevent puncture and other damage. Replace if insulation or vapor barrier is badly damaged. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 15300 – FIRE PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Section 15050 – Basic Mechanical Materials and Methods.

1.03 WORK INCLUDED

A. The work under this heading shall include furnishing and installing all materials as previously specified, or as shown on the drawings, as necessary for a complete automatic Fire Sprinkler System. The system shall be installed in accordance with all standards and requirements of the National Fire Protection Association and the City Fire Marshal.

B. The system shall be an automatic, wet-pipe system installed in accordance with all requirements and recommendations of NFPA Pamphlet 13.

C. The system shall cover all buildings.

D. All fire protection system materials and components shall be Underwriters Laboratories (UL) listed and labeled, and Factory Mutual approved for the application anticipated.

1.04 DRAWINGS

A. The Contractor shall submit to the Architect/Engineer for approval, complete installation drawings showing the Sprinkler System layouts. The layout shall indicate all of the sprinkler piping, sprinkler head locations and details of anchors and supports as required.

B. The Sprinkler System shall be laid out to eliminate all conflicts between the Sprinkler System and the structure including the Mechanical and Electrical Systems as they are shown on the contract drawings.

C. The layout shall indicate coordination between such items as ductwork, lights, structural members, etc.

D. Drawings shall be submitted to the City Fire Marshall and stamped as approved by him before submittal to the Architect/Engineer for approval.

E. The Sprinkler System shall be designed and installed by persons regularly engaged in this type of work and approved by local and state authorities.

PART 2 – PRODUCTS

2.01 WATER SERVICE PIPE, FITTINGS AND SPECIALS

A. Water service pipe, fittings and specials shall be ductile-iron pressure pipe, fittings and specials as specified in Section 15050 – Basic Mechanical Materials and Methods.

2.02 ABOVE GROUND SPRINKLER PIPE

A. Sprinkler pipe shall meet ASTM A795 and/or A135, and shall be UL listed and FM approved. All pipe shall have a minimum Corrosion Resistance Ratio, CRR = 1.00 or greater, as per UL listing. All piping shall be black carbon steel, except in FM approved dry systems where pipe is to be "hot dip" galvanized in accordance with ASTM A795 zinc coating specifications. Sprinkler Contractor shall supply mill certificates verifying that the products submitted from the manufacturer meet the above criteria.

2.03 GATE VALVES

A. Gate valves shall be approved outside screw and yoke (O.S. & Y), iron body, wedge gate valves, Underwriters pattern.

2.04 INDICATOR POST OPERATORS

A. Gate valves outside building shall have Underwriters approved indicator post operators located where shown on the drawings.

2.05 CHECK VALVES

A. Check valves shall be approved iron body, clearway, horizontal, swing check valves, Underwriters pattern.

2.06 FIRE DEPARTMENT CONNECTIONS

A. Furnish and install Fire Department connections for the Sprinkler System as indicated on the drawings.

B. Fire Department connections shall be chromium-plated type, installed complete with valves and piping. Caps shall be furnished and all threads shall conform to local Fire Department threads. A sign shall be provided reading "FIRE DEPARTMENT CONNECTION – SPRINKLERS."

2.07 ALARM

A. Alarm provisions shall consist of water alarm gongs.

2.08 SPRINKLER HEADS

A. Sprinkler heads shall be pendant type with concealed piping.

2.09 FIRE HYDRANTS

A. Fire hydrants shall be of the compression type for 5' burial, constructed for 300 psig and shall conform to AWWA Specification C-502. Each hydrant shall have two 2-1/2" nozzles and one pumper nozzle with threads as required by the local Fire Department. Each hydrant shall have an auxiliary gate valve and box. Hydrants shall be set so that nozzles are at least 12" above the ground. Provide a gravel bed at the bottom of each hydrant for drainage. Hydrants shall be Dresser Model 300, 5-1/4" valve size with red finish.

PART 3 – EXECUTION

3.01 WATER SERVICE

A. Water service shall be constructed in conformance with paragraphs “Excavation” and “Backfilling” of Section 15050 – Basic Mechanical Materials and Methods, and the following:
   1. General: Piping for fire sprinkler water service, as indicated on plan, shall be of the type and materials specified herein and shall be used exclusively throughout the job. The pipe and accessories shall be of new and unused material.

   2. The full length of each section of pipe shall rest solidly upon the pipe bed, the recesses excavated to accommodate the bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relayed. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for the work, except by permission of the Architect/Engineer.
   3. Water shall be kept out of the trench until the material work is not in progress. Open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipes or fittings. Any section of pipe found to be defective before or after laying shall be replaced with new pipe without additional expense to the Owner.
   4. Cast-iron bends shall have lugs for water socket clamps and shall be installed with tie rods. Tie rods shall be installed as recommended by the State Fire Inspection Bureau. Concrete anchor blocks shall be installed at bends and tees as required to adequately protect all joints.
   5. After the pipe is laid, the joints complete and the trench partially backfilled (leaving the joints exposed for examination), the water service and Sprinkler System piping shall be thoroughly flushed and shall be subjected to a water pressure test of 200 lbs per square inch for 2 hours. All exposed pipe, joints, fittings, valves and hydrants shall be carefully examined during the open trench test. Joints showing visible leakage shall be made tight. Cracked or defective pipe fittings, valves or hydrants disclosed in the pressure test shall be replaced by the Contractor with sound material, and the test shall be repeated until the test results are satisfactory to the Architect/Engineer and the State Fire Marshal.

3.02 SPRINKLER SYSTEM

A. The Sprinkler System shall be installed in conformance with Pamphlet 13 of the National Fire Protection Association and all requirements of the City Fire Marshal and the State Inspection Bureau.

END OF SECTION

SECTION 15400 – PLUMBING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Section 15050 – Basic Mechanical Materials and Methods.

B. Refer to Mechanical Equipment Schedule and Plumbing Fixture Schedule located on the drawings.

1.03 WORK INCLUDED

A. The work under this section shall include furnishing and installing the following:
   1. All piping, fixtures and equipment inside the building specified or shown on the drawings for the Plumbing Systems.
   2. All sewers, utilities, connections and appurtenances outside the building specified or shown on the drawings for the Plumbing Systems.

PART 2 – PRODUCTS

2.01 WATER METER

A. Furnish and install a new water meter at location shown. Meter shall be of the type used by the City Water Department. Meter shall be valved on each side and have ¾" valved drain.

2.02 WALL HYDRANTS

A. Wall Hydrants shall be Woodford Model 65, or the equivalent by Zurn, Wade, Josam or J.R. Smith. Hydrants shall be of non-freeze, anti-siphon, self-draining construction with ¾" hose connection, loose key stop, brass facing and piping, and chrome-plated face. Provide an inside stop and waste valve, Walworth No. 4D, or equal, for each hydrant at an accessible location. Check wall thickness before ordering and install 30" above grade unless otherwise shown on the drawings.

2.03 STREET WASHER HYDRANTS

A. Street washer hydrants shall be Woodford Model Y70, or the equivalent by Josam, Wade or Zurn. Hydrants shall be of non-freeze construction for 5' burial, with ¾" hose connection, loose key stop, brass body and piping. Provide an inside stop and waste valve Walworth No. 4D, or equal, for hydrant system at an accessible location. Anchor top of each hydrant with a 12" x 12" x 4" thick concrete pad at grade level, and provide a 12" x 12" x 12" gravel bed at bottom of hydrant for drainage.

2.04 HOSE BIBBS

A. Hose bibbs shall be Chicago No. 952, chrome-plated hose bibbs with hose end, removable tee handle and a backflow preventer spout.

2.05 DRAINS

A. Furnish and install all drains as specified and shown on the drawings. Provide flashing as specified under paragraph "Flashing" of this section. Drains shall be Acorn, J.R. Smith, Josam, Wade or Zurn. J.R. Smith numbers are used below.

1. Roof Drains: J.R. Smith Figure 1010RC, cast-iron roof drain with flashing clamp, removable mushroom-type cast-iron dome and steel deck clamp. J.R. Smith Figure 1020 side outlet roof drain may be used if necessary due to restricted space.
2. Overflow Drains: J.R. Smith Figure 1070 cast-iron roof drain with flashing clamp, removable mushroom-type cast-iron dome, adjustable overflow level and deck clamp.
3. Floor Drains in Finished Areas: J.R. Smith Figure 2010A, cast-iron body with bottom outlet, seepage flange, weep holes and adjustable round nickel-alloy strainer.
4. Floor Drains in Finished Areas with Tile Floors: J.R. Smith Figure 2010B cast-iron body with bottom outlet, seepage flange, weep holes and adjustable square nickel-alloy strainer.
5. Floor Drains in Unfinished Areas: J.R. Smith Figure 2530 cast-iron body with cast-iron grate, trap and backwater valve.
6. Downspout Nozzles: J.R. Smith Figure 1770 cast-bronze nozzle with cast-bronze wall flange.

2.06 BACKFLOW PREVENTER

A. Backflow preventer shall be Watts Regulator No. 909, or approved equal. Valve shall be bronze body with stainless steel internal parts and rubber check valve assemblies. Valve assembly shall be complete with two non-rising stem gate valves or full port positive shut off ball valves, union connections and strainer, and shall meet performance requirements of A.W.W.A. Standard C506.

2.07 GAS-FIRED HOT WATER HEATERS

A. Gas-fired hot water heaters shall be installed as shown on the drawings complete with water, gas and vent connections. Heaters shall be designed for use with natural gas and shall be approved by the American Gas Association. The heater shall be of manufacturer and capacity shown on the drawings. Connector and stack shall be Metalbestos Type B vent. Heater shall have relief valve, thermostatic controls, hose bibb drain, insulated jacket and shall be installed in accordance with the rules of the gas company. Relief valve discharge shall be piped to a floor drain. Water heaters with input ratings of 200,000 BTUH or greater shall be ASME constructed and stamped.

2.08 HOT WATER CIRCULATING PUMP

A. Furnish and install the hot water circulating pump of the capacity, model and manufacturer listed on the Mechanical Equipment Schedule, or approved equal. Pump to be suitable for potable water applications.

B. All parts of pump in contact with water shall be of bronze or stainless steel construction. Pump shall have a hardened stainless steel shaft with integral filter. Bearings are to be lubricated by the circulating fluid. Motor shall be non-overloading at any point on the pump curve and shall have impedance protection.

2.09 PLUMBING FIXTURES

A. General: Plumbing fixtures shall be furnished and installed in a neat and workmanlike manner with proper connections to supply and drainage piping. All fixtures shall be free of flaws and defects of any sort in material and workmanship and shall operate perfectly when

installed in accordance with the manufacturer's directions. The manufacturer shall agree to replace all or any part of the fixtures which show flaws or defects due to faulty manufacturing.

B. The Contractor shall be responsible for providing proper grounds for all fixtures requiring same. Fixtures shall conform to current commercial standards for Sanitary Cast-Iron Enameled Ware and Staple Vitreous China Plumbing Fixtures recommended by the U.S. Department of Commerce. Fixtures specified hereinafter shall be the standard products of one of the manufacturers listed below unless otherwise noted:
   1. American Standard
   2. Bradley
   3. Crane
   4. Eljer
   5. Kohler

C. Protection of Fixtures and Accessories: This Contractor shall be responsible for protection of the plumbing fixtures and accessories during construction. He shall replace at his own expense any fixture or accessory that is marred, scratched, defaced or broken. Fixtures shall be covered with building paper and wooden crates during construction.

D. Mounting Heights: Fixtures shall be mounted at heights shown on the drawings, or as directed by the Architect/Engineer.

E. Piping: All exposed piping and fittings to plumbing fixtures shall be chromium-plated. Lavatory, drinking fountain and sink P-traps shall be swivel pattern, 17-gauge minimum.

F. Manufacturer and Model: See Plumbing Fixture Schedule located on the drawings.

G. Provisions for the Handicapped: Lavatories shall have 27" clearance from the floor to the bottom of the apron. Exposed hot water and drain piping shall be insulated with pre-molded Trap Wrap insulation, #500 as manufactured by Brocar or approved equal. Urinals shall be mounted with the rim 17" above the floor. Water closets shall be mounted with the seat from 17" to 19" from the floor. Water coolers shall be specifically designed for use by handicapped persons and mounted with controls not more than 3' from the floor. This Contractor shall be familiar with and strictly follow all requirements and recommendations of the Americans with Disabilities Act (ADA).

PART 3 – EXECUTION

3.01 WATER SERVICE

A. The water service shall be constructed in conformance with paragraphs "Excavation" and "Backfilling" in Section 15050 – Basic Mechanical Materials and Methods, and the following:
   1. PVC Pipe and Fittings 4" and Smaller: Shall be Schedule 40 with cemented (solvent welded) joint slip socket type fittings, as specified in Section 15050 – Basic Mechanical Materials and Methods. PVC piping may be used up to 5' from the building line.
   2. From 5' outside the building line to the first shutoff valve in the building, the water piping shall be Type "K" annealed copper tube with flared brass compression fittings. Steel pipe sleeves shall be installed at all concrete slab/water penetrations 2" larger in diameter than the copper pipe. Copper pipe to be enclosed in 1" foam insulation to reduce contact with soil and pipe sleeves.
   3. Gate Valves: Valves shall be designed for a minimum water working pressure of not less than 150 lbs per square inch. Valves shall have joints as required for the piping in which they are installed. Gate valves shall have a clear waterway equal to the full nominal diameter of the valve and shall be opened by turning to the left. The operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the maker's initials, pressure rating and year in which manufactured cast

on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified water working pressure. Valves shall be iron body, brass mounted N.R.S. and shall conform to the Standard Specification of the American Water Works Association, 7F.1, or to the requirements of Federal Specification WW-V-58.

4. Valve Boxes: Valve boxes shall be of cast-iron or extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16". The cover shall have the word "Water" cast in the metal. Boxes shall be installed over each outside gate valve. The boxes shall be of such length as to provide, without extension, the minimum cover over the pipe required by the local plumbing code.
5. Installation: The water service shall be installed as indicated on the drawings and shall be valved as shown.
   a. Piping: Piping for the water service shall be of the type and materials specified herein. The pipe and accessories shall be of new and previously unused material. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate the joints. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.

      The pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work. Water shall be kept out of the trench until installation is complete. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe or fittings. Any section of pipe found to be defective before or after laying shall be replaced with new pipe without additional expense to the Owner.
   b. Shutoff Valve: The service line shall be connected to the main in conformance with city water department requirements and shall have a gate valve and valve box.
   c. Valve Box: When water main is located in a paved street having curbs, the valve box shall be located directly in back of the curb. Where no curbing exists, the valve box shall be installed in an accessible location, beyond the limits of streets, walks or driveways.
   d. Setting Valves and Valve Boxes: Valves and valve boxes shall be installed in the lines a shown on the drawings. Valves and valve boxes shall be set plumb and centered with valve boxes placed directly over the valves. Earth fill shall be carefully tamped around the valve box to a distance of 4' on all sides of the box or to the undisturbed trench face if less than 4'. Valves shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the valve shall be inspected in opened and closed positions to see that all parts are in working condition.
   e. Pipe Joints: Before making joints, the socket and plain ends of the pipe shall be cleaned of foreign material. The spigot end of the pipe and the inside of the rubber ring gasket shall then be coated with approved lubricant with the pipe in approximate alignment. Then the spigot shall be positioned in the socket of the adjoining pipe and the spigot shall be forced into the socket using the proper assembly tools.
   f. Concrete Anchor Blocks: Shall be installed at all underground tees and elbow in water service to prevent the fittings from being blown off the lines when under pressure.
   g. Test: After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected to a pressure test of 50 lbs per square inch in excess of normal operating static pressure at the points of reading. All exposed pipe, joints, fittings and valves shall be carefully examined during the open trench test. Joints showing visible leakage shall be made tight.

Cracked or defective pipe, fittings or valves disclosed in the pressure test shall be repeated until the test results are satisfactory to the Inspector.

h. Water Service Sterilization: The completed water service and water distribution system shall be sterilized with chlorine before acceptance for operation.
   (1) Material – Hypochlorite: Liquid hypochlorite shall conform to the requirements of Federal Specification O-B-411, Grade D.
   (2) Method: The amount of chlorine applied shall be such as to provide a dosage of not less than 100 parts per million. The chlorinating material shall be introduced to the water service in a manner approved by the Architect/Engineer. After a contact period of not less than eight (8) hours, the system shall be flushed with clean water until the residual chlorine is not greater than 0.2 parts per million. Valves shall be opened and closed during sterilization.

3.02 NATURAL GAS SERVICE

A. The natural gas service shall be constructed in conformance with paragraphs “Excavation” and “Backfilling” in Section 15050 – Basic Mechanical Materials and Methods and the following:
   1. The natural gas service is intended for the distribution of natural gas and materials, appurtenances and workmanship used in the system shall be suitable for the accomplishment of this purpose. Any section of the gas service system that is found defective in material or workmanship before acceptance shall be corrected to the satisfaction of the Architect/Engineer at no additional cost to the Owner. The natural gas service, gas pressure regulator, gas meter and tapping of the existing main shall be furnished and installed by the Gas Company; cost accruing therefrom shall be included in the Contract. This Contractor shall furnish and install all piping from outlet of meters to all fixtures and equipment using gas as specified in paragraph “Natural Gas Piping.”

2. Underground gas piping shall be ASTM A 53, Type E, Electric-resistance welded or Type S, Seamless; Grade B; Schedule 40 black steel. All underground gas piping and fittings shall have a factory-applied, corrosion-resistant, polyethylene protective coating. Pipe and fittings shall be treated with a compatible primer prior to tape application. The protective coating shall have a thickness of 20 mils; a synthetic adhesive, a water absorption of 0.02 percent maximum and a water vapor transmission rate of 0.10 gallon maximum per 24 hours per 100 sq. in.
3. Field-applied coatings shall be per ASTM D4397, polyethylene tape applied in number of layers and procedure required to provide properties equivalent to the factory-applied coating described above.

3.03 OUTSIDE SANITARY SEWERS

A. Sanitary sewers 5' or more outside the building shall be constructed in conformance with paragraphs "Excavation" and "Backfilling" in Section 15050 – Basic Mechanical Materials and Methods, and the following:
   1. Materials: Sanitary sewers shall be constructed with PVC sewer pipe and fittings as specified in Section 15050 – Basic Mechanical Materials and Methods.
   2. Installation: Sanitary sewers shall be installed in conformance with ASTM Standard C12, and the following:
   3. Location: Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10' to a water supply main or service line, except that where the bottom of the water pipe will be at least 12" above the top of the sewer pipe, the horizontal spacing may be a minimum of 6'. Existing sewers shall be relocated as shown.
   4. Crossing Above Water Lines: Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10' each side of the crossing shall either be cast-iron or PVC pipe without any joint closer horizontally than 3' to the crossing, or shall be fully encased in concrete. The thickness of the concrete, including that at the pipe joints, shall not be less than 4".
   5. Pipe Laying: The bottom of the trench shall be shaped to give substantially uniform circumferential support to the lower fourth of each pipe. Pipe laying shall proceed up grade with the spigot ends of bell and spigot pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. As the work progresses, the interior of the sewer shall be cleared of all dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed. Trenches shall be kept free from water until the pipe-jointing material has set and pipe shall not be laid when the conditions of the trench or weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely closed to the satisfaction of the Inspector so that no trench water, earth or other substance will enter the pipe or fittings.
   6. Cleanouts: Exterior cleanouts shall be furnished and installed at each change in direction of a horizontal run and at maximum intervals of 100'-0" in the horizontal lines or according to governing codes and ordinances. Cleanouts shall be of the same size as the pipe, at least 4" minimum, and shall be J.R. Smith Figure 4223-U, set in concrete pad (except in sidewalk to be flush with finished sidewalk), with vandal-proof screws, or the equivalent by Acorn, Wade or Zurn.

3.04 SANITARY DRAINAGE

A. Material: All above-ground sanitary drainage and vent piping shall be standard weight, galvanized steel pipe with black cast-iron drainage fittings; or service weight cast-iron soil

pipe and fittings; or type DWV copper with cast-copper drainage fittings. Copper shall not be used for water closed or urinal waste or vent fixture connections.

All sanitary drainage piping underground shall be service weight cast-iron soil pipe and fittings. Cast-iron pipe shall extend 5' beyond the building line.

B. Installation: All horizontal drainage and vent piping shall be run at a uniform grade of not less than ¼" per foot of fall in the direction of flow, except as noted. Soil and waste vent pipes shall extend through the roof full size. All lavatories and sinks shall be connected to waste lines with TY fittings.

C. Pipe Joints: Joints in cast-iron soil pipe shall be made by using pipe and fittings with plain end spigots and positive, double-seal, elastomeric compression type gaskets conforming to ASTM C-564. Joints in "No-Hub" cast-iron pipe shall be made by use of "No-Hub" elastomeric gaskets and stainless steel clamps.

D. Vertical Stacks: Vertical stacks shall be supported at floors with clamp anchors as required to relieve joint stresses.

E. Traps: Traps shall be installed on all fixtures and inlets to drainage system except where traps are integral with equipment or fixtures. No fixture shall be double trapped. All exposed or accessible P-traps shall have bottom cleanout plugs.

F. Cleanouts: Cleanouts shall be furnished and installed on all vertical waste or soil stacks at a height of 30" above the finished floor at the base of each stack and at each change in direction of a horizontal run and at maximum intervals of 50'-0" in the horizontal lines. Cleanouts shall be of the same size as the pipe up to 4" and at least 4" for larger pipe.

Cleanouts in exterior locations shall be J.R. Smith Figure 4220, or the equivalent by Acorn, Josam, Wade or Zurn. Chamfered concrete pad 24" x 24" x 6" shall be poured around the cleanout.

Cleanouts in finished walls shall be J.R. Smith Figure 4452, or the equivalent by Acorn, Josam, Wade or Zurn.

Cleanouts in floors shall be J.R. Smith Figure 4020, or the equivalent by Acorn, Josam, Wade or Zurn with nickel alloy top.

Cleanouts in tile floors shall be J.R. Smith Figure 4040, or the equivalent by Acorn, Josam, Wade or Zurn.

G. Air Conditioning Equipment Drains: Air conditioning equipment drains shall be installed where required or shown on the drawings. All piping shall be type DWV copper with solder type copper fittings. From outdoor equipment, a drain valve shall be installed in the trap for winter drain down. Drain lines shall be run to the nearest roof drain for roof-mounted equipment.

3.05 FLASHING

A. Vents: Extend vents 12" above roof. Vents through the roof shall be flashed and counterflashed using four-pound sheet lead. Flashing shall extend at least 12" in all directions from the pipe and at least 12" above the roof. Counterflashing shall be turned down inside the top of the pipe and shall overlap the lower flashing by 4".

B. Floor Drains: All floor drains, except those in floor laid on the ground, shall be installed with four-pound sheet lead flashing extending 18” from the drain in all directions between the structural and finished floor.

C. Roof Drains and Overflow Drains: Roof drains and overflow drains shall be provided with four-pound sheet lead flashing extending a minimum of 10” beyond outer dimension of drain in all directions. Flashing shall be thoroughly mopped to roof.

3.06 WATER PIPING SYSTEM

A. Pipe and Fittings: All water piping, from the shut-off valve after the entry into the building, shall be hard-drawn copper water tubing, Type L with solder joint, wrought-copper fittings of same weight as tubing, as specified in Section 15050 – Basic Mechanical Materials and Methods and shall be installed above slab. Under slab is not allowed unless specifically shown on drawings and sleeved. Solder joints shall be made with 95-5 tin antimony solder and flux as recommended by the manufacturer and applied to clean surfaces only. Solder containing lead shall not be used. Pipe sizes shown on the drawings shall be nominal inside diameter unless otherwise indicated.

B. Precautions During Construction: Extreme care shall be taken during construction to keep dirt and foreign matter out of the systems. Stored pipe shall have open ends closed and all equipment shall have all openings protected. Each piece of pipe or equipment shall be visually examined as it is being installed and all dirt removed.

C. Exposed Pipe and Fittings: All exposed pipe and fittings in finished rooms used in connection with plumbing fixtures shall be chromium-plated brass pipe with plated, cast-brass fittings.

D. Valves: Shall be provided on all water piping wherever shown or specified, using adapters where required. All removable or replaceable equipment shall have shutoff valves. Valves shall be as specified in Section 15050 – Basic Mechanical Materials and Methods.

E. Water Piping Installation: The Contractor shall furnish and install all water pipe lines and risers necessary to supply all fixtures and equipment as shown or specified. All pipe shall be run as direct as possible, avoiding unnecessary offsets and shall be concealed in finished rooms unless shown or specified otherwise. Proper allowance shall be made for expansion and all lines and risers shall be blocked as may be necessary to prevent noise or vibration when water is turned on or off.

F. Pitch: All pipes shall be pitched as required to allow the system to be drained. Furnish and install ¾" hose end drain valves at all low points of the systems.

G. Branch Valves: Each branch shall be separately valved and all such valves shall be accessible.

H. Air Chambers: Air chambers 18" long and of the same size as the branches shall be placed vertically on the end of all supply branches to each fixture. All pipe lines shall be arranged to give ample room for the pipe insulation specified elsewhere.

I. Water Hammer Arrestors: Zurn "Shoktrol" or equal shall be installed at the end of each hot water and cold water branch. Arrestors shall be sized in accordance with manufacturer's sizing table.

3.07 NATURAL GAS PIPING

A. Furnish and install the natural gas distribution system from the gas meter to all gas using equipment as specified and shown on the drawings and in conformance with all applicable requirements of the Gas Company, the National Fire Protection Association, and local ordinances and codes.
   1. Materials: All gas piping shall be Schedule 40 black steel pipe as specified in Section 15050 – Basic Mechanical Materials and Methods. Pipe smaller than 2" shall have screwed fittings. All screwed fittings, except valves, shall be standard weight, beaded, melleable iron. Pipe 2" and larger shall have welded fittings. Welded fittings shall

conform to ASA B-16-9. Valves shall be Dezurik Figure 425, or the equivalent by Rockwell or Homestead.

2. Installation: All piping shall be reamed to full size after cutting and all screwed joints shall be made up with teflon pipe thread tape applied to the male threads. Welded joints shall be made in accordance with HPACCA Standard Manual of Pipe Welding.
   a. All pipe shall be run true to line without pockets and with even pitch to a suitable point where an approved drain cock shall be provided.
   b. No unions shall be used in concealed piping. All outlets not connected to equipment or appliances when the Contractor has completed his work shall be closed with valves and plugs.
   c. Install a valve in each branch takeoff.
   d. All connections to gas-burning equipment shall be made by this Contractor. Each connection shall have a valve.
   e. Ferrous gas piping installed underground in exterior locations shall have a minimum of 24" earth cover and shall be protected from corrosion by approved factory-applied coatings, wrapping material, or by another approved manner.
   f. Underground ferrous gas piping shall be electrically isolated from the rest of the gas system with listed or approved isolation fittings installed a minimum of 6" above grade.

3.08 INSPECTIONS, TESTS AND ADJUSTMENTS

A. During the progress and after completion of the work included under this Specification, the Contractor shall make all required tests at his own expense in the presence of the Inspector.
   1. Materials: All materials shall, so far as possible, be subjected to standard test by the manufacturers before shipment.
   2. Sanitary and Storm Drainage: All drain, soil, waste, storm drainage and vent pipes (including branch bends and ferrule joints) shall be tested by closing all openings before any fixtures are set and filling the entire system with water or by air pressure tests as requested by the Inspector.
   3. Water Piping: All water piping shall be tested under minimum 125 psi pressure and shall be without indication of leak under that pressure. All leaks shall be closed to the satisfaction of the Inspector.
   4. Initial Flushing: The piping system shall be flushed out with water to remove as much loose material as possible. Strainers shall be in place, with start-up screen installed, during this operation and blowoffs and drains shall be open.
   5. Gas Piping: All gas piping shall be tested with compressed air at 25 psig and shall show no drop in pressure in a 2-hour period. Leaks shall be located by soap testing.
   6. Final Test of System: Under completion, the entire system shall be tested under operating conditions. Water shall be turned into all supply lines and all fixtures shall be demonstrated to operate properly. Valves and stops shall be adjusted, packed and repacked as may be required to eliminate leaks and produce proper flow. Piping shall be adjusted to provide proper circulation and to prevent hammer and thumping.
   7. Test of Water Closets and Urinals: Water closets and urinals shall be tested and adjusted to flush efficiently without undue noise.
   8. Inspection: Upon completion of the work, the Contractor shall obtain certificates of inspection and approval from all city and state authorities having jurisdiction. All certificates shall be turned over to the Inspector.

END OF SECTION

SECTION 15485 – MEDICAL GAS PIPING SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

A. This section includes tubing, piping and related accessories for oxygen systems, designated "oxygen."

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 11 Section "Medical Equipment" for medical equipment and outlets requiring medical gas services.
   2. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
   3. Division 15 Section "Supports and Anchors" for piping hangers and supports.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Installer Qualifications: Engage an experienced Installer of medical gas systems.
   1. The term "Experienced Installer" is specified in Division 1 Section "Reference Standards and Definitions."

B. Provide medical gas piping systems complying with requirements of NFPA 99C "Gas and Vacuum Systems" Level 3.

C. Provide compatible accessories, tube, fittings, and valves for each existing system.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for the following:
   1. Special purpose valves.
   2. Medical gas accessories.
   3. Storage tanks.

B. Maintenance data for inclusion in Operating and Maintenance Manuals.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver and store large medical gas accessories on factory-installed shipping skids, tubing with sealing plugs in end or with end protection and small accessories in factory-fabricated fiberboard containers.
   1. Store pre-cleaned and sealed medical gas tube, fittings, valves and accessories with sealing plugs and sealing packaging intact.
   2. Label medical gas tube, fittings, valves and accessories that have not been pre-cleaned, and that have been pre-cleaned but have seal or packaging that is not intact, with temporary labels indicating that cleaning is required before installation

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Medical Gas Systems Accessories:
      Amico Corporation

2.02 MEDICAL GAS TUBING, GENERAL

A. Copper Tube, Fittings, Valves and Piping Components: Factory-cleaned, -purged, and –sealed, and marked or labeled "CLEANED FOR MEDICAL GAS SERVICE," "CLEAN FOR OXYGEN SERVICE," "ACR/OXY," "OXY," "NITROGENIZED."
   1. Components required, but not available cleaned for medical gas use, may be provided, but must be cleaned before use as specified below under "Preparation."

B. Pipe joining materials, specialties, and basic installation requirements are specified in Division 15 section "Basic Piping Materials and Methods."

2.03 MEDICAL GAS TUBE

A. Soft Copper Tube: ASTM B 88, Type K, water tube, seamless, annealed temper.

B. Hard Copper Tube: ASTM B 88, Type K or Type L, water tube, seamless, drawn temper.

C. Pre-cleaned and Sealed Copper Tube: ASTM B 88, Type K or Type L, water tube, seamless, drawn temper, cleaned for medical gas use, purged, and with ends sealed.

D. ACR Copper Tube: ASTM B 280, "ACR," air conditioning and refrigeration tube, seamless, hard-drawn temper, cleaned for medical gas use, purged, and with ends sealed. Tube cleaned only for refrigeration and air conditioning use may be provided, but must be cleaned before use.

2.04 MEDICAL GAS TUBE FITTINGS

A. Wrought-Copper Fittings: ASME B16.22, solder-joint, pressure type.

B. Bronze Tube Flanges: ASME B 16.24, Class 300.

C. Flexible Connectors: Bronze or stainless-steel flexible pipe connectors as specified in Division 15 Section "Mechanical Sound, Vibration, and Seismic Control."

2.05 MEDICAL GAS TUBING JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP (copper-phosphorus) Series alloys. Flux is prohibited, except when used with bronze fittings.

B. Threaded-Joint Tape: Polytetrafluoroethylene (PTFE) plastic.

C. Gasket Material: ASEM B16.21, nonmetallic, flat, asbestos-free, and suitable for oxygen use.

2.06 VALVES

A. General duty valves such as gate, globe, check, ball, and butterfly valves for use in associated piping such as water supply are specified in Division 15 Section “Valves.”

B. Ball Valves 3” and Smaller: Bronze-body, full-flow, chrome-plated brass ball valve, with Buna-N or TFE seat seals and stem seals, blow-out-proof stem, threaded or braze-joint ends, locking-type handle, designed for quarter turn between open and closed positions and for 300 psig working pressure.
   1. Provide union-type body with bolted swing-away center section
   2. Provide factory-cleaned, factory-sealed (for oxygen use) and factory-installed, Type K or L copper tube extensions with pressure gage installed downstream from valve in pressure systems and upstream from valve in vacuum systems.

C. Safety Valves: Bronze body with settings to match system requirements.
   1. Pressure Safety (Relief) Valves: ASME construction.
   2. Vacuum Relief Valves: Equipment manufacturer’s option.

D. Pressure Regulators: Brass or bronze body and trim, spring-loaded, diaphragm-operated, relieving type, manual pressure setting adjustment, rated for 250 psig minimum inlet pressure and capable of controlling delivered air pressure within 0.5 psig for each 10 psig inlet pressure.

E. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, 200 psig minimum rated working pressure, capable of automatic discharge of collected condensate.

2.07 CASING FOR BURIED MEDICAL GAS TUBING

A. PVC (Polyvinyl Chloride) Plastic Pipe: ASTM D 1785, Schedule 80, for solvent cement joints.

B. PVC Plastic Pipe Fittings: ASTM D 2467, Schedule 80, socket type for solvent cement joints or threaded type for screwed joints.

C. PVC Plastic Solvent Cement: ASTM D 2564.

2.08 MEDICAL GAS SYSTEM ACCESSORIES

A. General: Provide the following medical gas system accessories from manufacturer of existing accessories, compatible with existing systems.

B. Service Outlets: Include brass valve and body block with seals in roughing-in and finishing assemblies, steel outlet box and cover plate; 3/8” Type K or L copper tube brazed to valve; and pressure outlets with automatic secondary service valve to prevent gas flow when primary valve is removed.
   1. Quick-Connect Coupling: Indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment with positive locking ring when retains equipment stem in valve during use.
   2. DISS-Type Coupling: (Diameter Index Safety System) threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
      a. Oxygen Outlets: Refer to plans.
   3. Wall Outlet Cover Plates: One piece, stainless-steel plate with NAAMM AMP 503, No. 4 finish; metal with chrome-plated finish; or anodized aluminum with permanent, color-coded, medical gas identifying label matching corresponding outlets.

C. Service Hose Assemblies **(Owner provided and installed unless contracted separately)**: Color-coded, conductive, neoprene, 1/4" or 5/16" inside diameter, of lengths indicated, and with indexed or DISS-type end-connection fittings suitable for medical gas service indicated.
   1. Hose Color: Black, when medical gas service is clearly indicated.
   2. Oxygen Hose Assemblies: 8' long, with quick-connect oxygen fittings, valve on one end and stem on other end.

2.09 MEDICAL GAS STORAGE TANK SYSTEMS

A. Oxygen Reserve Supply: Manifolded header for high-pressure cylinders, fabricated of copper tubing or brass pipe and fittings and suitable for pressures up to 4000 psig. Header shall have inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gage and inlet connections for number of cylinders indicated.

2.10 IDENTIFICATION

A. Refer to Division 15 Section "Mechanical Identification" for piping (both underground and within building), tubing, valves, gages, alarms, accessories, and bulk storage tank labels.

PART 3 – EXECUTION

3.01 PREPARATION

A. General: Where factory-precleaned and –capped tubing and piping are not available, or when precleaned tubing and piping must be recleaned because of exposure, perform the following procedures:
   1. Clean medical gas pipe and pipe fittings, tube and tube fittings, valves, gages and other components of oil, grease, and other readily oxidizable materials as required for oxygen service in accordance with GCA G-4, 1-85 "Cleaning Equipment for Oxygen Service."
   2. Wash medical gas piping, tubing and components in hot alkaline cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of one pound of chemical to three gallons of water.
      a. Scrub to ensure complete cleaning.
      b. Rinse with clean hot water after washing to remove cleaning solution.

3.02 TUBING APPLICATIONS

A. General: Refer to Part 2 of this section for the following materials.

B. Interior: Use "Precleaned and Sealed Copper Tube" with wrought copper fittings and brazed joints.

C. Buried: Use "Soft Copper Tube" with wrought copper fittings and brazed joints.

3.03 TUBING JOINT CONSTRUCTION

A. Requirements for brazed, threaded and flanged joint construction are specified in Division 15 Section "Basic Piping Materials and Methods."

3.04 CASING JOINT CONSTRUCTION

A. Joint PVC protective casing pipe and fittings with threaded or solvent cement joints.
   1. Threaded Joints: Conform to ASME B1.20.1, "Tapered Pipe Threads" for field-cut threads. Join pipe and pipe fittings as follows:

a. Note the internal length of threads in fittings and proximity of internal seat to determine how far pipe should be threaded into fitting.
b. Align threads at point of assembly.
c. Damaged Threads: Do not use pipe with damaged threads.

2. Solvent Cement Joints: Conform to ASTM D 2855.

3.05 TUBING INSTALLATION, GENERAL

A. Basic installation requirements are specified in Division 15 Section "Basic Piping Materials and Methods."

B. Install supports and anchors in accordance with Division 15 Section "Supports and Anchors."
1. Spacing Between Hangers: As described in NFPA 99C for Level 3 installations.

C. Valve Applications: Use ball valves specified in this section for main shutoff and zone valve duties.

D. Install thermometers and pressure gages in accordance with Division 15 Section "Meters and Gages."

E. Install buried medical gas tubing in a conduit fabricated with PVC pipe and fittings. Do not extend casing through foundation wall.

3.06 ACCESSORIES INSTALLATION

A. Furnish number and type of complete, non-interchangeable service outlets indicated to manufacturer of equipment specified in other sections requiring service outlets that will be installed by the equipment manufacturer. Service outlets shall be same as outlets specified in preceding "Service Outlets" paragraph.

B. Install accessories in accordance with NFPA 99C and manufacturer's printed installation instructions.

C. Install manifolds firmly anchored and with seismic controls as indicated.

3.07 MEDICAL GAS STORAGE TANK INSTALLATION

A. Install storage tanks furnished by others.

B. Install storage tanks plumb and level, firmly anchored, in locations indicated. Orient so controls and devices needing servicing are accessible.

C. Install storage tanks firmly anchored and with seismic controls as indicated.

3.08 CONNECTIONS

A. Install tubing and piping adjacent to equipment to allow servicing and maintenance.

B. Connect medical gas tubing to equipment, gas manifolds and accessories with unions. Install with ball valves and strainers.

3.09 LABELING AND IDENTIFICATION

A. Install labeling on valves, valve box covers and alarm panels in accordance with requirements of NFPA 99C.

B. Captions and Color Coding: Use the following or similar medical gas captions and color coding for accessories when specified and where required by NFPA 99C.
   1. Oxygen: White letters on green background.

3.10 FIELD QUALITY CONTROL

A. System Clearing: Purge medical gas system tubing using oil-free dry air or nitrogen after installation of tubing but before installation of service outlet valves, alarms and gages.

B. Pressure Test: Subject each section of each system, except high-pressure air and nitrogen, to test pressure of from 150 psig to 200 psig and high-pressure air and nitrogen systems to test pressure of 250 psig with oil-free dry air or nitrogen before attachment of system components after installation of station outlets with test caps (when supplied) in place and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water.

C. Standing-Pressure Test: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20% above normal line pressure

but not less than 66 psig. Subject vacuum and evacuation systems to 12 to 18” of mercury minimum vacuum in lieu of pressure test.

D. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

E. Repair medical gas systems and replace components that fail tests specified.

3.11 COMMISSIONING

A. Provide the services of a factory-authorized service representative to inspect installation and to provide start-up service.

B. Operate and adjust operating and safety controls. Replace damaged and malfunctioning control and equipment discovered by the service representative.

C. Checks Before Start-Up: Perform the following final checks before start-up:
   1. Verify that specified tests of piping systems are complete.

END OF SECTION

SECTION 15880 – AIR DISTRIBUTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Section 15050 – Basic Mechanical Materials and Methods.

B. Refer to Section 15250 – Mechanical Insulation.

C. Refer to Section 15990 – Testing, Adjusting and Balancing.

D. Refer to Mechanical Equipment Schedule located on the drawings.

1.03 WORK INCLUDED

A. The work under this section shall include furnishing and installing a complete air distribution system including all heating ventilating and air handling equipment, ductwork and accessories as specified and shown on the drawings for the heating ventilating and air conditioning systems.

PART 2 – PRODUCTS

2.01 ROOFTOP HEATING AND AIR CONDITIONING UNIT(S)

A. General: Unit shall be of the single-zone package type combination air-to-air cooling with indirect gas heat and shall be mounted on a full perimeter roof curb. Unit shall be AGA certified, ARI rated and UL certified. Unit shall be of manufacturer and model as indicated in the Mechanical Equipment Schedule.

B. Heating and Cooling Capacities: Shall be as shown on the Mechanical Equipment Schedule.

C. Unit Cabinet: Shall be constructed of galvanized steel, bonderized and coated with baked enamel finish. Blower compartment shall be insulated with ½" fiberglass insulation. Aluminum foil faced fiberglass insulation shall be used in furnace compartment. Cabinet shall be designed for horizontal discharge as shown on drawings.

D. Compressor: The unit shall contain a welded, full hermetic compressor with suitable vibration isolators and shall have a 5-year warranty. Compressor shall have a factory-installed temperature-actuated crankcase heater.

E. Coils: Shall be constructed of aluminum plate fins mechanically bonded to copper tubes with all joints brazed.

F. Fans and Motors: The indoor air fan shall be of the forward-curved, centrifugal-type with alternate belt drive and motor. Blower shall have corrosion-resistant finish and be dynamically balanced.

G. Outdoor Air Fan: Shall be of the propeller type, powered by a direct drive motor, discharging upward and be dynamically balanced.

H. Heating Section: Heat exchanger shall be of tubular sectional design and constructed of aluminized, 20-gauge steel. Burners shall be of the in-shot type, constructed of aluminized steel. Unit shall include induced draft combustion with a direct-spark ignition system and redundant main gas valve.

I. Economizer: Shall have return air and outside air dampers, outdoor air filter and hood and a fully-modulating electric control system with ambient air temperature control with adjustable set point. Economizer shall be capable of introducing up to 100% outdoor air and shall be of the integrated type, capable of simultaneous economizer and compressor operation. Unit shall be equipped with a gravity relief damper.

J. Filters shall be 2" thick fiberglass throwaway type. Filter face velocity shall not exceed 360 FPM at nominal air flows and only one filter size shall be required.

K. A full perimeter roof curb shall be provided and installed with the Air Conditioning unit. The curb shall be constructed of 16 gage galvanized steel with wood nailer strip and 1" fiberglass side wall insulation.

L. Controls and safeties shall include the following:
   1. Unit controls shall be complete with self-contained low voltage control circuit.
   2. Unit shall incorporate the following solid state compressor protections with reset capability at space thermostat.
      a. Compressor over-temperature, overcurrent.
      b. Low pressure switch.
      c. Freezestat evaporator coil.
      d. High pressure switch.
   3. Heating section shall be provided with the following minimum protections:
      a. High temperature limit switch.
      b. Induced draft motor centrifugal switch.
      c. Flame rollout switch (manual reset).
      d. Flame proving controls.
   4. Compressor Cycle Delay: Compressor shall be prevented from restarting for a minimum of 5 minutes after shut-down.
   5. Space thermostat shall be a 2-stage heating/2-stage cooling electronic programmable wall-mounted thermostat with a system "HEAT-COOL-AUTO-OFF" and a fan "ON-AUTO" switching subbase. Thermostat shall be supplied and mounted by the Mechanical Contractor. Wiring shall be by the Electrical Contractor under the supervision of the Mechanical Contractor. Proper operation of the thermostat is the responsibility of the Mechanical Contractor. The Owner shall be instructed on the use of all thermostat features by the Mechanical Contractor.

2.02 ROOF EXHAUST FANS – CENTRIFUGAL TYPE

A. Roof Exhaust Fans: Shall be installed as shown on the drawings and shall be of the type, wheel size, manufacturer and capacity shown on the Mechanical Equipment Schedule. Fans shall be of the centrifugal type, belt-driven or direct driven as indicated on the Mechanical Equipment Schedule. V-belt drives shall be designed for 50% overload and shall have adjustable pitch motor sheave. Motors shall be mounted on adjustable bases. Housings shall be fully weatherproofed and all metal parts exposed to air stream shall be given a sprayed-on insulating undercoating. Outlets shall be provided with removable bird screens. Units shall be mounted on approved vibration isolating bases.

Fan bearings shall be ball bearing type and provided with adequate and accessible means of lubrication. Each unit shall have a fused or thermal element type disconnect located in the motor compartment. Fans shall be quiet in operation. Fan housings shall be easily removable for access to all parts.

B. Dampers: Shall be motorized type furnished by the fan manufacturer.

C. Roof Curbs: Shall be of prefabricated metal type and designed for mounting furnished roof exhaust fans. Curbs shall be of the insulated type with insulating lining. Curbs shall be designed for flashing to the roof in an approved manner with a raised cant at a height to match the roof insulation. Roof curbs shall be furnished with nailer strips, gasketing material and drawn-down lugs to ensure a watertight bond. Curb shall have adequate means for mounting dampers where dampers are specified or shown on the drawings.

2.03 CEILING TYPE EXHAUST FANS

A. Furnish and install ceiling type exhaust where indicated on the drawings. Fans shall be of the centrifugal type as shown on the drawings. Fans shall be quiet in operation, shall have gravity type dampers and roof outlets. Fans shall be of capacity and manufacturer on the Mechanical Equipment Schedule.

2.04 REGISTERS

A. Furnish and install all registers for openings as indicated on the drawings. Registers are indicated by the letter “R”. Furnish complete units with frames and opposed blade dampers with removable key damper operators. Registers shall be of the manufacturer indicated on the Mechanical Equipment Schedule.

B. Finish for steel registers shall be factory-applied white baked enamel. Plaster frames shall be furnished for plaster walls and ceilings.

2.05 GRILLES

A. Furnish and install all grilles for opening as indicated on the drawings. Grilles are indicated by the letter “G”. Furnish complete units with frame and blades. Grilles shall be of manufacturer indicated on the Mechanical Equipment Schedule.

B. Finish for steel grilles shall be factory white baked enamel. Plaster frame shall be furnished for plaster walls and ceilings.

2.06 DIFFUSERS

A. Furnish and install all diffusers as indicated on the drawings. Sizes, types and capacities shall be as shown on the drawings. Diffusers shall have equalizing deflectors to provide uniform air distribution and to allow for directional control. Diffusers shall be installed symmetrically with ceiling layout and lights. Volume dampers shall be furnished for diffusers as indicated in the Mechanical Equipment Schedule. Diffusers shall be of manufacturer indicated on the Mechanical Equipment Schedule.

B. Finish for diffusers shall be factory-applied white baked enamel. Plaster frames shall be provided for diffusers in plaster ceilings.

2.07 COMBINATION FIRE/SMOKE DAMPERS

A. Furnish and install at locations shown on plans, or as required by code combination fire/smoke dampers meeting the following specifications. Frame shall be galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement.

B. Each combination fire smoke damper shall be 1-1/2 hour fire rated under UL Standard 555 or greater where noted on architectural plans, and bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. The leakage rating under UL555S shall be Leakage Class II (10 cfm/ft. at 1” w.g.)

C. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 250º F, 350ºF, or 450ºF depending upon the actuator. Appropriate electric “Firestat” operator shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications for both

dampers and actuators. Manufacturer shall provide factory assembled sleeve of 16" minimum length (contractor to verify requirement). Factory supplied caulked sleeve shall be 16 gage for dampers up to 36" wide by 24" tall and 14 gage above 36" wide X 24" tall.

D. Combination Fire/Smoke dampers shall be Ruskin FSD6O rectangular dampers and Ruskin FSDR25 for round dampers or approved equal with correct mounting frames and sleeves for actual installation. Combination Fire/Smoke dampers for corridors ceiling shall be Ruskin FSD36 with internally mounted actuator.

E. Each combination fire and smoke damper shall include an integral factory furnished and installed duct smoke detector compatible with the building fire alarm system. Assembly by Ruskin DSDN or approved equal.

F. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.

2.08 FIRE DAMPERS

A. Furnish and install at locations shown on the drawings or as required by code fire dampers meeting the following requirements. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Fire damper links shall be of the test strength recommended to prevent nuisance closing. All fire dampers shall conform to the requirements of NFPA Pamphlet 90A and shall meet the required UL Standard 555.

B. High Velocity Round or Oval Fire Dampers: High velocity fire dampers shall be of the folding blade type designed for minimum static pressure drop. Fusible links shall be accessible from either side of the damper. Each damper shall be furnished complete with a galvanized welded steel sleeve (round or oval) and closure compartment to house the folded blades. Fire dampers shall be Ruskin FD35 with 165°F fusible link or approved equal.

C. Rectangular Fire Dampers: Fire dampers for rectangular ductwork shall be of the folding blade type with the hinged blades completely out of the air stream of the single hinged blade type. Fusible links shall be accessible from either side of the damper. Each damper shall have a galvanized welded steel sleeve (rectangular or square) and closure compartment to house the folded blades. Rectangular fire dampers mounted in the horizontal plane are to be spring loaded. Fire dampers shall be Ruskin DIBD with 165°F fusible link or approved equal.

D. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.

E. Each fire damper shall be provided with spare fusible link(s) secured to the damper.

2.09 DUCT SMOKE DETECTORS

A. All smoke detectors shall be listed by Underwriters Laboratories Inc. for use in air handling systems. They shall be designed to provide detection of combustion gases, and fire and smoke in air conditioning and ventilating duct systems in compliance with the National Fire Protection Associations. Further, they shall contain an ionization-type detector and air-sampling chamber with sampling tubes extending the width of the air duct (maximum of 9'-3/4").

B. The detector used with a remote power supply and control circuitry shall perform the detection functions and operate its own integral SPDT alarm contacts as well as transmit signals to activate the trouble and alarm contacts. The integral alarm contacts shall be

capable of handling up to 5 amperes resistive at 120 VAC. The detector shall be suitable for outdoor installation in a NEMA 3R enclosure as shown on the drawings.

C. Alarm condition pilot lights will be visible on the front of all detectors.

D. The duct smoke detectors shall be furnished and installed by the Mechanical Contractor. Shut-down of the supply fan shall be through interlock wiring to the duct smoke detector. Interlock wiring to the supply fan and power wiring is by the Electrical Contractor.

PART 3 – EXECUTION

3.01 DUCTWORK CONSTRUCTION

A. Adhere to drawings as closely as possible. If approved, the Contractor may vary run and shape of ducts and make offsets during progress of work if required to meet structural or other interferences.

B. Install ductwork in adherence to ceiling height schedules indicated, consulting with other trades, and in conjunction with them, establish necessary space requirements for each trade so as to maintain required clearances.

3.02 STATIC PRESSURE CLASS 1" WG DUCTWORK

A. All ductwork, other than that specified elsewhere, shall be considered to be static pressure Class 1" wg. (SPC 1) ductwork, and shall be furnished and installed as shown on the drawings as as specified below.

B. Materials: All SPC 1 ducts, except flexible ducts, shall be constructed of galvanized steel sheets with galvanized steel bracing and supports. Gauges of steel and aluminum (and joints and reinforcements for round and rectangular ducts) shall conform to tables in the HVAC Duct Construction Standards of the Sheet Metal and Air-Conditioning Contractors National Association Edition 1 1985. Rectangular ducts shall conform to Table 1-4 and round ducts shall conform to Table 3-2 and 3-3.

C. Flexible Ductwork: May be used for final connections to variable volume boxes, individual air diffusers, grilles and registers where shown on the drawings. Flexible ductwork connected to insulated ducts shall have 1" thick insulation. All flexible ducts shall conform to NFPA 90A and shall be listed under Underwriters Laboratories, Inc. 181. Maximum length of any flexible duct section shall be 4 feet.

D. Support: All ductwork shall be substantially and neatly supported on heavy iron straps or angles, riveted or bolted to ducts and properly anchored to the construction so that horizontal ducts are without sag or sway, vertical ducts are without buckle and all ducts are free from the possibility of deformation, collapse or vibration. See SMACNA Section 4.

E. Seams and Joints: Longitudinal seams shall be Pittsburgh seams, or grooved seams.
   1. Transverse joints in low pressure round ducts shall be slip type, secured with sheet metal screws equally spaced on 6" centers maximum with a minimum of three screws per joint. Exposed inside edge of duct at joint shall point in direction of air flow. Transverse joints in rectangular ducts shall conform to Table 1-11 in SMACNA.
   2. All duct joints and seams in round and rectangular ducts shall be sealed with an approved duct sealer.
   3. All duct joints and seams for ductwork located outside the building shall be sealed watertight with Hardcase DT tape and RTA-50 adhesive applied in complete accordance with manufacturer's instructions.

F. Terminology: Terminology and construction of joints and seams shall be recommended in the HVAC Duct Construction Standards as published by SMACNA, Edition 1 1985.

G. Fittings:
1. Elbows: All elbows shall have an inside radius not less than the width of the ducts in the direction of the curve. See SMACNA Figure 2-2, Type RE-1.
Where space conditions do not permit a full radius elbow, changes in direction shall be made using mitered elbows with multiple turning vanes (SMACNA Figure 2-3 and 2-4) or short radius elbows with

one turning vane placed at a distance from the inside radius equal to 1/3 the duct width. The inside radius of short radius elbows shall be 2/3 the duct width. The turning vane shall extend 1/3 the duct width past the elbow curvature in the direction of air flow. See SMACNA Figure 2-2, Type RE-3.
Elbows for use in SPC 1 round ducts up to 8" diameter may be short radius, adjustable type elbows.
2. Transitions: Full duct cross-section areas shall be maintained through transitions. Angles between centerline and side of diverging transition shall be no greater than 15º. Angle between centerline and side of converging transition shall be no greater than 30º.
3. Offsets: Shall be constructed with inside radii not less than the width of the duct in the direction of the curve. Mitered elbow or short radius elbows, as specified under paragraph "Elbows" above, may be used where space is restricted.
4. Taps: Branch tap-in of small branch ducts to large main ducts shall be 45º entry tap-ins constructed as shown in SMACNA Figure 2-8.
Collar taps for air outlet connections on exposed ductwork shall be made with joint connection folded over the inside of the main duct and without exposed flanges. Outlet collar shall be of the same dimensions as outside dimension of air outlet frame.

H. Outlet Frames: Where duct terminate at grilles, registers or screens, they shall be furnished with angle or channel iron frames with mitered, welded corners and with suitable provisions for attaching said grilles, registers or screens.

I. Dampers: Motorized dampers occurring in ductwork will be furnished as specified in the temperature control section, 15950. Other dampers shall be as shown on the drawings.

J. Access Doors: Hanged, airtight, access doors shall be provided where required for access to control elements or for inspection. Doors shall be adequately sized for ease of maintenance of concealed items and shall have airtight gaskets.

A. Exposed Round Ductwork: Transverse spiral and round duct joints shall be made with the Spiralmate Round Duct Connector or an approved equal. The Spiralmate components shall be of standard catalog manufacturer as supplied by Ductmate Industries, Inc.

The installation of the Spiralmate Round Duct Connector shall be in accordance with the manufacturer's printed instruction and installation manuals.

The Spiralmate Round Duct Connector consists of the following components:
1. Two mating round duct connector flanges with an integral sealant.
2. A gasket between the two mating flanges.
3. A roll-formed closure ring that is drawn tight with a bolt and nut.

3.03 EQUIPMENT HOUSINGS

A. General: Equipment housings shall be provided for the mixing dampers as shown on the drawings and as hereinafter specified. This Contractor shall cooperate with all other trades in

the construction of the housings and shall furnish all required dimensions. All sheet metal housings, steel framing for bracing, equipment supports and metal partition walls shall be furnished and installed by this Contractor in accordance with the following.

B. Materials: All sheet metal and steel framing material shall be galvanized. Casings shall be constructed of 18-gauge sheet metal with structural iron stiffeners.

C. Construction: Entire housing shall be made airtight, suitably braced with structural iron members, and free from breathing or vibration. Housing shall terminate at masonry walls and at floors with 1-1/2" x 1-1/2" x 3/16" angles.

D. Housing shall be internally insulated as specified in paragraph "Insulating Duct Lining."

E. Openings for unit connections, dampers and access doors shall be framed with angle iron stiffeners.

F. Housings shall be as detailed on the drawings. The Contractor shall submit shop drawings for approval before fabricated.

G. Access doors shall be installed where shown and as required for access to all equipment. Doors shall be complete with hinges, gaskets and "Ventlock" No. 205 latches as manufactured by Ventfabrics of Chicago, Illinois, or equal.

3.04 FLEXIBLE CONNECTIONS

A. Flexible connections shall be installed between all ductwork and air handling equipment. Connections shall be of fireproof material and suitable for temperatures and pressure involved. Flexible connections shall have at least 1" of slack material when installed.

3.05 VOLUME DAMPERS

A. Volume dampers shall be installed where shown on the drawings. Volume dampers shall be two gauges heavier than the duct in which they are installed and shall be reinforced to prevent vibration and noise. All volume dampers occurring in concealed ductwork shall be installed with shafts vertical. In ducts over 14" width, use multi-louvered opposed blade dampers. Provide Young Regulator Model 301 flush cup regulator for dampers above gyp board or plaster ceilings.

3.06 INSULATING DUCT LINING

A. General: Insulating duct lining shall be provided in locations noted on the drawings and specified below. Duct sizes shown on the drawings shall be inside dimensions of acoustic duct liner. Insulation and materials shall be Manville, Knauf, Owens-Corning or Armstrong. All insulation shall have composite (insulation and facing) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and Underwriters Laboratories 723 not exceeding a "flame spread" of 25 and "smoke developed" of 50.
   1. Accessories, such as adhesives, mastics, cements, etc. shall have the same component ratings as listed above.
   2. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

B. Material: Internal duct liner insulation shall be made from inorganic glass fibers bonded by a thermosetting resin. The air stream side surface shall be smooth with a firmly bonded, fire resistant coating to prevent erosion of the insulation. The density shall be 1-1/2 lb per cubic foot with a thickness of 1". The R-value shall not be less than 4.0 at 75º F.

The duct liner insulation shall satisfactorily operate up to velocities of 5000 fpm and temperature to 250º F. The smooth surface shall offer minimum resistance to air flow and have efficient sound absorption abilities. The noise reduction coefficient rating shall not be less than 0.70.

The duct liner insulation shall satisfy the fire rating requirements listed above and also satisfy NFPA 90A and 90B standards. The duct liner insulation shall comply with Federal Specifications HH-I-545B (ASTM C 1071, Type I) and SMACNA Application Standards for Duct Liners.

C. All acoustic duct liner shall be 1" thick unless otherwise noted and shall be installed where shown on the drawings and for the ducts scheduled below:

System	Location
Supply Air System	All square and rectangular ducts
Return Air System	All square and rectangular ducts

D. Installation: Acoustic duct liner shall be adhered to interior of ducts with adhesive, completely coating all duct surfaces. Mechanical fasteners shall be used on top and sides for ducts exceeding 24" in height or width and shall be spaced 18" on centers.

3.07 FLUES

A. Furnish and install a prefabricated metal, Type B flue where shown on the drawings for the gas-fired furnace. Installation shall conform to manufacturer's recommendations and the National Board of Fire Underwriters. Flue shall be flashed at the roofline and shall have a weatherproof cap. Flue shall be Metalbestos, or equal.

3.08 VENT CONNECTIONS

A. Vent connections, from the draft diverters to the chimney, shall be made with galvanized steel ducts as specified for ductwork in this section.

END OF SECTION

SECTION 15990 – TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Section 15010, Basic Mechanical Requirements, is a part of this section of the Specificatiosn.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Section 15880 – Air Distribution.

B. Refer to Division 16 – Electrical.

1.03 JOB CONDITIONS

A. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the testing, adjusting and balancing work specified.

B. Testing, adjusting and balancing shall be performed when outside conditions approximate design conditions indicated for cooling function.

1.04 QUALIFICATIONS

A. The Contractor shall have an independent testing and balancing agency, approved by the Engineer, which specializes in the testing and balancing of heating, ventilation and air conditioning systems. All work by this agency shall be done under the direct supervision of a qualified Test and Balance Engineer employed by the agency. All instruments used by this agency shall be accurately calibrated and maintained in good working order. The testing and balancing agency shall submit proof of having successfully completed at least five projects of similar size and scope.

1.05 SUBMITTALS

A. Data Sheets:
   1. Submit data sheets on each item of testing equipment required.
   2. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.

B. Report Forms:
   1. Submit specimen copies of report forms.
   2. Forms shall be 8-1/2" x 11" paper for looseleaf binding with blanks for listing of the required test ratings and for certification of report.
   3. Reports shall be on form published by the AABC, or equal.

1.06 OPERATING INSTRUCTIONS

A. Reports shall be certified by the testing engineer that the methods used and the results achieved are as specified.

1.07 MEASUREMENT AND PAYMENT

A. Should corrective measures caused by faulty installation require retesting, adjusting and balancing, such work shall be at no additional expense to the Owner.

B. Corrective measures, other than the above, shall be made only as directed by the Architect/Engineer in writing and shall be covered by Change Order at an agreed amount before corrective work is done.

PART 2 – PRODUCTS

2.01 AIR BALANCE INSTRUMENTS

A. Alnor velometer with probes and Alnor pitot tube.

B. Rotating vane anemometer. Taylor Instrument Company, 4" size.

C. ASHRAE Standard pitot tubes, stainless steel 5/16" outside diameter, lengths 18" and 26", Dwyer Model 160.

D. Magnehelic differential air pressure gauges. 0" to 0.5", 0" to 1.0" and 0" to 5.0" water pressure ranges, each arranged as a standard pitot tube, Dwyer Series 2000.

E. Combination inclined-vertical portable manometer. Range 0" to 5.0" water, Dwyer No. 400.

F. Portable flexible U-tube manometer. Magnetic mounting clips, range 18" to 0.18" water, Dwyer No. 1215-20.

2.02 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

A. Insertion thermometers with graduation at 0.5º F for air and 0.1º F for water.

B. Sling psychrometer.

C. Tachometer, centrifugal type.

D. Revolution counter.

E. Clamp-on volt/ammeter, minimum ranges: 0/600 volts on three scales; 0/800 volts on five scales.

PART 3 – EXECUTION

3.01 AIR DISTRIBUTION AND HYDRONIC SYSTEMS

A. Test, adjust and balance systems in accordance with AABC National Standards for Field Measurements, Total System Balance, Air Distribution and Hydronic Systems, of latest issue.

3.02 REFRIGERATION CAPACITY TESTS

A. Conduct refrigeration capacity test in each condensing unit during a period of stable operation.

B. Verify settings of safety and operating controls.

C. Make three trial observations, record readings of:
   1. Ambient air temperature.
   2. Air temperatures entering and leaving cooling coils, accurate to 1º F.
   3. Air flow through cooling coils, accurate to nearest 100 CFM.
   4. Refrigerant temperatures accurate to 1º F.

5. Compressor power input readings of volts and amperes in each phase, accurate to nearest 100 VA.

D. Performance Report: Use readings to calculate tons of refrigeration capacity along with power input required for that capacity along with power input required for that capacity and compare with manufacturer's ratings to determine percent effectiveness.

3.03 SUBMITTAL OF REPORTS

A. Fill in test results on approved forms. Submit three certified copies of the required test reports to the Architect/Engineer for approval.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 16010 – GENERAL PROVISIONS

PART 1 GENERAL

1.01 The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

1.02 ELECTRICAL DIVISION INDEX

16010 General Provisions
16110 Raceways
16120 Wires and Cables
16130 Outlet Boxes
16133 Cabinets
16140 Wiring Devices
16150 Motors
16155 Motor Starters
16160 Panelboards
16170 Motor and Circuit Disconnects
16181 Fuses
16410 Electrical Service
16450 Grounding
16460 Transformers
16500 Lighting Equipment
16501 Lamps
16502 Ballasts and Accessories
16511 Fluorescent Fixtures
16722 Fire Alarm System
16740 Telephone System

1.03 REQUIREMENTS

A. Furnish all labor, materials, service, equipment and appliances required to complete the installation of the complete Electrical System in accordance with the Specifications and Contract Drawings.

B. Refer to the Table in Division 15, Section 15902, 1.02 A for specific direction on items to include or exclude from this work.

1.04 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and the terms and conditions of the Electrical Utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge.

B. Underwriters Laboratories (UL) or Factory Mutual (FM): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. or Factory Mutual, Inc. The label of, or listing by, UL or FM is required.

C. Standards: Where referenced in these Specifications or on the Drawings, the publications and standards of the following organizations shall apply: Joint Commission on Accrediation of Healthcare Organizations (JCAHO), American Society of Testing and Materials (ASTM), Insulated Power Cable Engineers Association (IPCEA), National Fire Protection Association

(NFPA), American National Standards Institute (ANSI), and National Electrical Manufacturers Association (NEMA).

D. Conflicting code requirements shall be brought to the attention of the Architect. Where two or more codes apply, the most stringent of the codes shall govern.

1.05 SUBMITTALS AND SUBSTITUTIONS

A. Material List: Within 30 days of Contract Award or Notice to Proceed and before material is ordered, the Contractor shall submit for approval a list of all proposed material and equipment, indicating manufacturer's name and general description.

B. Shop Drawings: Submit for approval a minimum of six copies of all shop drawings no later than 30 days after the material list has been approved and prior to ordering any material. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation. Indicate in the transmittal that submittal has been reviewed and accepted and all Contract deviations identified. In addition to specific references or requests; submit shop drawings for the following applicable items: panelboards, lighting fixtures, transformers, primary cable and gear, alarm systems and all special equipment.

C. Substitutions may be requested in accordance with Section 01640, 1.04.

PART 2 PRODUCTS

2.01 EQUIPMENT REQUIREMENTS:

A. The Electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has Electrical requirements other than indicated on the Electrical Drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. All adjustments to the Drawings reflecting the Electrical System shall be delineated in a submittal to the Architect immediately upon knowledge of the required adjustments. The complete responsibility and costs for such adjustments shall be assigned to the respective section of these Specifications in which the equipment is furnished.

2.02 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer.

B. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the Contract requirements and meets the approval of the Architect.

C. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

2.03 ALTITUDE:

A. Equipment affected by altitude shall perform satisfactorily the function intended at the altitude of the project site. The altitude of this project is 5000 feet mean sea level.

PART 3 EXECUTION

TECHNICAL SPECIFICATIONS

3.01 GENERAL:

A. Fabrication, erection and installation of the complete Electrical System shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surface where Electrical equipment or material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of the prevailing conditions.

B. TEMPORARY POWER AND LIGHTING: Furnish and install all temporary Electrical facilities required for construction and safety operation. No part of the permanent Electrical Systems or the existing Electrical System may be used for temporary service unless approved by the Architect.

C. UTILITIES

1. GENERAL: The Drawings reflect requirements of the serving utilities based on information derived from representatives of the utilities. During the project design phase, the fact that the Architect may undertake to show the utility(s) requirements, does not necessarily indicate that the Architect represents the utilities or their requirements; therefore, within 10 working days after Contract Award and/or Notice to Proceed has been issued, the Contractor shall be responsible for coordinating the requirements of the utilities for the Power System. The Owner shall be responsible for coordinating the requirements for the Telephone and Television Systems.

2. Any deviations from the documents shall be brought to the attention of the Architect no later than 10 working days after Award of Contract and/or Notice to Proceed. Failure to notify the Architect within the 10-day time frame signifies the acceptance of documents and utility requirements by the Contractor and all associated costs therein.

D. EXCAVATION: Comply with Section 02200, Earthwork.

E. PERFORMANCE TESTS

1. Thoroughly test all fixtures, services and all circuits for proper operating conditions and freedom from grounds and short circuits before acceptance is requested. All equipment appliances and devices shall be operated under load conditions.

2. After the interior-wiring system installation is complete and at such time as the Architect may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation to assure that all material continues to possess all the original characteristics as required by the governing codes and standards as listed in these Specifications.

3. After occupancy of the building has taken place and nominal building power loads have been established, make voltage readings at all panelboards. Based on these readings make final adjustments of taps on all transformers in the building as directed by the Architect. Submit to Architect correspondence and/or drawing delineating readings.

4. Perform such other tests as required by other sections of these Specifications or as requested by the Architect to prove acceptability.

5. Furnish all instruments and labor for testing.

F. OPERATING INSTRUCTIONS AND MANUALS

1. Instructions: Without additional charge to the Owner, the Contractor shall provide an experienced and competent representative to instruct the Owner or his representative fully in the concept, theory, operations, adjustment and maintenance of all equipment furnished for the Electrical System. Contractor shall provide at least two (2) weeks notice to the Architect in advance of this period.

2. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data. Operating and maintenance manuals as required herein shall be submitted to the Architect for review and distribution to the Owner not less than two (2) weeks prior to the scheduled final acceptance of the Project.

3. Other: The above requirements are in addition to specific instruction and manuals specified for individual systems or equipment.

G. DRAWINGS

A. General: The Electrical Drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The Architectural and Structural Drawings shall be considered as a part of the work insofar as these Drawings furnish the Contractor with information relating to the design and construction of the building. Architectural Drawings shall take precedence over Electrical Drawings. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbows, pullboxes and accessories as may be required to meet such conditions.

B. Field Measurements: The Contractor shall verify the dimensions governing the Electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the Drawings.

H. LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the Drawings; however, the exact location shall be determined after thoroughly examining the general building plans and by actual measurements during construction to avoid conflicts with any Structural, Architectural, or other trades, with all locations subject to the approval of the Architect.

B. Verify with the Architect all locations of conduit, boxes, etc., stubbed in the floor prior to installation.

I. IDENTIFICATION AND SIGNS

A. Mark each individual motor controller, disconnect switch, transformer and remote control device to identify each item with its respective service using engraved nameplates.

B. Provide nameplates with engraved lettering not less than 3/8" high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.

C. Identify panelboards, transformers and cabinets by engraved nameplates with descriptions indicated on the Drawings together with indication of the location of the feeder overcurrent protection. Install on inside of hinged doors or panelboards and cabinets.

Example: Panel 2P
120/208V, 3-phase, 4-wire
Fed from Panel MDP/cct. #4

D. Provide warning signs on all equipment or devices operating at 300 volts or more, reading "DANGER-480 VOLTS", etc. with white letters on red background of standard code size. Signs shall be decals.

E. All underground utilities indicated on the Drawings shall have a 6" wide plastic marker installed continuously in the trench at 12" below grade. The marker shall have continuous markings embossed in the tape identifying the system installed, i.e., communications, telephone, power, and secured computer.

F. Identify all exposed conduits, junction and pullboxes at maximum intervals of twenty feet and as indicated below. Identify exposed conduits according to the system carried by means of Brady #B-350 permacode thin film pipe markers or approved equal by the Owner. Identify junction and pullboxes by painted on stencils or approved labels. Identification shall be placed at necessary intervals on straight conduit runs, close to all terminations, adjacent to all changes in directions and where conduits pass through walls or floors. Stencils to be painted on with legible contrasting colors without abbreviations. Painting shall be in accordance with DIVISION - FINISHES.

1. Approved Electrical Conduit Color Codes:

120/208 Volt	Black
277/480 Volt	Orange
Fire Alarm	Red
Nurse Call	Blue
Voice Paging	Pink
Television	Purple
Security	White
Telephone	Gray
Monitoring	Maroon/White
Grounding	Green
Emergency. 120/208	Red/Black
Emergency. 277/480	Red/Orange
Computer/Data	Dark Blue/ White
Medical Gas Alarms	Yellow
110 Volt Control	Black/White

G. Identify all receptacle and switch devices with the circuit and overcurrent protection device. Identification may be by waterproof, permanent marker on the rear of the device cover plate or as approved by the Architect and Owner.

3.10 WARRANTY:

A. Deliver originals of all guarantees and warranties on this portion of the work to the Architect. Warrant all equipment, materials and workmanship for one year in accordance with the terms of the Contract.

3.11 PRODUCT HANDLING:

A. Use all means necessary to protect Electrical materials and equipment before, during and after installation and to protect the installed work of other trades.

3.12 RECORD DRAWINGS:

A. As part of this Contract, the Contractor shall provide a complete marked-up set of Contract Documents indicating all changes to the documents during the project construction phase to the Architect. Changes to the Electrical System shall be documented on a set of "Record Drawings" on a daily basis.

END OF SECTION

SECTION 16110 - RACEWAYS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special General Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 CONDUITS

A. Rigid Steel Conduit: Rigid, threaded, thick-wall with zinc-coated on the inside and either zinc-coated or coated with an approved corrosion-resistant coating on the outside.

B. Rigid Aluminum Conduit: Rigid, threaded, thick-wall type, approved for the application.

C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated or coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

D. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 degrees fahrenheit, 11,000 psi flexural strength, 8,600 psi compression strength, approved 90 degree conductors. Carlon, Triangle or approved equal.

E. Electrical Metallic Tubing (EMT): Mild steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

F. Flexible Conduit: Commercial Greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.

G. Liquid-Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid-tight PVC outer jacket and a separate grounding conductor installed in the conduit.

H. Conduit Size: Minimum conduit size 1/2" except where specifically approved for equipment connections. Sizes not noted on the Drawings shall be as required by the NEC.

2.02 CONDUIT FITTINGS

A. Rigid Steel Conduit, IMC and EMT Fittings: Iron, steel, or die-cast only.

B. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc-coated or cadmium plated. Aluminum alloy fittings shall conform to the characteristics defined by UL for rigid aluminum metallic conduit and shall not contain more than 0.04 percent copper.

C. Rigid Non-metallic Conduit Fittings: Approved for the purpose and as recommended by the manufacturer.

D. Flexible Conduit Fittings (Commercial Greenfield): Either die-cast, steel, or malleable iron only with insulated throats and shall be of one of the following types:

1. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.

2. Steel, multiple point type, for threading into internal wall of the conduit convolutions.

3. Wedge and screw type with angular in-edge fitting between the convolutions of the conduit.

E. Liquid-tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon, or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seal.

F. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set-screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either die-cast, steel, or malleable iron only, "Concrete-tight" or "Raintight", and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set-screws or indentations as a means of attachment are not permitted.

G. Bushings: Insulated type, designed to prevent abrasion of the wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC, and rigid aluminum conduit.

H. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each run of 100 feet of exposed conduit shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory-installed packing and a grounding ring.

I. Sealing Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

2.03 WIREWAYS:

A. Square D Company square duct lay in type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors, use standard lengths. Field cuts permitted where absolutely necessary. Rust-inhibiting phosphatizing coating on sheet metal parts. Blue-gray baked enamel finish. Hardware plated to prevent cross fittings, transposition section, gussett brackets, nipples, pull boxes, reducer fittings, wall flanges, panels or cabinet flanges, elbows, ceiling and wall support brackets and supporting hardware, etc.

2.04 FIRE AND SMOKING PROOFING COMPOUNDS:

A. Comply with Section 13900. No substitutions accepted.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. Conduit Systems: Rigid steel conduit, IMC, rigid non-metallic conduit or EMT unless otherwise specified.

B. Aluminum Conduit: Aluminum conduit may be used only in dry locations above ground in sizes two inch or larger for Power and Communications Systems.

C. Rigid Non-metallic Conduit: Install in accordance with manufacturer's recommendations. Joints shall be solvent welded. Field bends shall utilize approved bending equipment. Provide rigid steel elbows and rigid steel conduit risers on underground runs or runs in concrete. Provide a suitable bond wire in each run except low voltage communications runs. Underground runs under concrete slabs may be direct buried without concrete encasement if of approved type. Rigid non-metallic conduit may be installed outside the perimeter of the building only when encased in concrete. Concrete total encasement shall be a minimum of four inches around outside of conduit. Rigid non-metallic conduit is not permitted to be surface mounted in ducts, plenums or other air handling spaces. All 90 degree bends shall be rigid steel conduit. For encased conduits carrying 600 volts or more, the concrete shall be colored red using a permanent dye.

D. EMT: Not permitted underground or embedded in concrete.

E. Flexible Conduits: Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Length shall not exceed 5 feet without approval from the Architect and Owner. Install flexible conduit connections at all resilient-mounted equipment. Provide liquid-tight flexible conduit in exterior, wet or damp locations and for connections to wet pipe mechanical systems.

F. Conduit in Concrete: Rigid steel conduit or rigid non-metallic conduit may not be embedded in concrete that is in direct contact with the earth. When embedded, the outside diameter shall not exceed one-third the thickness of the concrete slab, wall or beam, shall be located entirely within the center third of the member, and the lateral spacing of conduits shall not be less than three diameter unless otherwise prohibited by Architect.

G. Steel Conduit in Ground: Rigid steel conduit that is not completely encased in concrete but is in contact with ground or on a vapor barrier shall be wrapped with Scotchwrap 51 half-lapped, or shall have an additional outside factory coating of polyvinyl chloride with a minimum coat thickness of 20 mils. Other PVC or Phenolic-resin epoxy coating material which is equally flexible and chemically resistant may be used providing approval by the Architect is obtained prior to the installation.

H. Exposed Conduits: Install exposed conduit systems parallel to or at right angles to the lines of the building. Right angle bends in exposed runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii not less than those of standard elbows.

I. Concealed Conduits: Install conduit systems concealed unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities, and where specifically approved by the Architect. Install concealed conduit systems in as direct lines as possible.

J. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

K. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

L. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls.

Sleeves that are used shall be sealed tight with rated fire and smokeproofing compounds as specified in Section 13900.

3.02 CONDUIT SUPPORTS

A. Supports: Provide supports for horizontal steel conduits and EMT not more than eight feet apart with one support near each elbow or bend and one support within one foot of each coupling, including runs above suspended ceilings.

B. Straps: Install one-hole pipe straps on conduits 1-1/2" or smaller. Install individual pipe hangers for conduits larger than 1-1/2". Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Trapezes: Install multiple (trapeze) pipe hangers, Uni-Strut or approved equal, where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by specifically designed and approved fasteners for the system used.

D. Hanger Rods: Install 1/4" diameter or larger steel rods for trapezes, spring steel fasteners, clips and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used. Power-driven fasteners may be used to attach pipe straps and hanger rods to concrete where approved by the Architect. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy Fasteners of ERICO Products, Inc., or approved equal. Wire wrapped around conduits and supporting members will not be accepted. Conduit fastened to the wall above the ceiling is not acceptable.

3.03 IDENTIFICATION: Identify per Section 16010, Paragraph 3.09F.

3.04 CLOSING OF OPENINGS:

A. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, including bus ducts, such openings, if unused, or the spaces left in such openings, shall be closed in a manner approved by the Architect and per Section 13900. All closure material along with installation methods shall retain the fire rating integrity of the surface being penetrated. All openings in walls or floors remaining after removal of existing conduits, raceways, or bus ducts shall be closed in a like, approved manner.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 16120 – WIRES AND CABLES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions.

B. Conditions (if any) and General Requirements apply to the work specified in this section.

C. General Provisions: Section 16010.

D. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 WIRES AND CABLES (600 VOLTS)

A. Type:

1. Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volt insulation unless otherwise specified or noted on the Drawings. Stranded conductors for No. 6 and larger and where elsewhere specified or noted on the Drawings.

2. All conductors shall be copper. Aluminum conductors will be permitted only on 600 volt and above systems.

B. Insulations: Type THWN insulation unless otherwise specified or noted on the Drawings. Type THWN minimum or type XHHW filled cross-linked polyethylene 90 degree C. thermosetting insulation for conductors larger than No. 6 and elsewhere as required by NEC. 90 degrees C. minimum insulation within fixture wireways of fluorescent fixtures.

C. Size: No. 12 minimum unless otherwise specified or noted on the Drawings. Not less than NEC requirements for the system to be installed.

D. Color Coding: Phase, neutral and ground conductors color-coded in accordance with NEC. Connect all conductors of the same color to the same phase conductors.

	Phase A	Phase B	Phase C	Neutral
120/240V/1 Phase	Black	Red	-----	White
208Y/120V/3 Phase	Black	Red	Blue	White
277/480V/3 Phase	Brown	Orange	Yellow Gray	

Ground shall be Green for all systems.

E. Conductors No. 12 and 10 shall be solid color compounded for the entire length and each like color shall be connected only to the particular phase throughout the project. Conductor sizes larger than No. 10 may be color-coded at each termination and in each box or enclosure with six inches of half-lapped 3/4" pressure sensitive, plastic tape of respective colors in lieu of solid color compound.

2.02 CONTROL CONDUCTORS:

A. Copper, minimum size No. 14 with 19/35 stranding, color-coded filled cross linked polyethylene 90 degree C. 600 volt insulation and neoprene or equal outer jacket, equal to General Electric SI-58109 or SI-58742. Multi-conductor control cables shall be provided where more than three control conductors are installed in the same conduit between common terminations. Provide two spare conductors minimum in each control cable.

2.03 COMMUNICATION AND ELECTRONIC CABLE:

A. As required or specified in the section of these Specifications specifying the equipment. Splices shall be crimped or soldered or shall use an approved connector.

2.04 VERTICAL CABLE SUPPORTS:

A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used without metallic sheath.

2.05 CONNECTORS AND LUGS

A. For copper conductors No. 6 and smaller: 3M Scotch-Lok or T & B Sta-Kin, or equal compression or indent type connectors with integral or separate insulating caps.

B. For copper conductors larger than No. 6: Solderless, indent, hex screw, or bolt-type pressure connectors, properly taped or insulated.

2.06 TAPE:

A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-1000. Equal to 3-M Super 88 Tape.

2.07 FEEDER CIRCUITS:

A. Single conductor feeder cables shall be of the size and type as indicated on the Drawings. Sizes shown are for copper conductors unless otherwise noted on Drawings.

2.08 BRANCH CIRCUITS

A. Branch circuits shall be No. 12 AWG copper minimum and shall be larger AWG size where indicated on Drawings. Where branch circuits exceed 100 ft. in length, the AWG size shall be increased to accommodate voltage drop.

B. Branch circuits to all equipment, fixtures and outlets shall include a white neutral and green wire equipment ground.

PART 3 EXECUTION

3.01 WIRE AND CABLE TESTS (600 VOLTS):

A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Architect, and

shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing, and conduct tests in the presence of the Architect. Submit written reports of the tests and results when requested by the Architect.

3.02 SPLICES (480 VOLTS AND UNDER):

A. Permitted only at outlets or accessible enclosures. Conductor lengths shall be continuous from termination to termination without splices unless approved by the Architect.

3.03 PULL WIRES:

A. In each empty conduit, except underground conduits, install a plastic line having tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard-drawn copper pull wire or a plastic line having a tensile strength of not less than 200 pounds.

3.04 RACEWAYS:

A. Install in rigid conduit, EMT, or flexible metallic conduit, unless otherwise specified or noted on the Drawings.

3.05 CABLE BENDS:

A. Radius or bends not less than ten times the outer diameter of the cable.

3.06 CONDUCTOR PULL:

A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed
and all conduits in which moisture collected have been swabbed out.

3.07 FEEDER IDENTIFICATION:

A. Tag feeder circuits in each enclosure with wrap-around circuit designation labels.

3.08 CONNECTORS AND LUGS:

A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.09 BUNDLING:

A. Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two-ply lacing or nylon straps.

3.10 15 KV CABLE INSTALLATION:

A. Install and terminate 15 KV cables in accordance with the manufacturer's approved recommendations. The conductors shall be free of kinks and twists, and all bends shall be formed with smooth radius not smaller than ten times the diameter of the cable nor smaller than the minimum radius recommended by the manufacturer, whichever is greater. Install cables in continuous lengths without splice unless specifically indicated on the Drawings. Install cable

terminations in accordance with the manufacturer's written recommendations. All cables in one conduit shall be pulled in together, using a suitable patented grip on the conductors and a basket weave grip over the insulation, arranged so the stress of pulling is applied to the conductor and not the insulation. Lubricate cables with Cablelube or Minerallac cable pulling compound of the type approved by the cable manufacturer and Architect. Simplex kits are not acceptable. Mark cables for phase identification at each termination by means of Brady "All Temperature" markers or other approved means. Left position Phase "A" black; center position Phase "B" red; right position Phase "C" blue.

3.11 WIRING FOR LOW-VOLTAGE SPECIAL SYSTEMS

A. General: For the purpose of this Specification, the word "cable" refers to both protected and unprotected cable installations. Special Systems refers to telephone, television, overhead paging, nurse call, building automation, security, data, and fire alarm systems.

B. Products: Approved cabling shall be used per Section 16120, 2.03.

C. Protection Requirements: All special systems cable runs inside walls and floors shall be in rigid conduit or BX cable per Section 16110. Cables placed in existing walls may be run in flex if approved by the Architect in advance. Runs exterior to walls and floors shall be as shown in the table below:

System	Requirement	Reference Section
Telephone	Approved cable without additional protection	16740, 16117
Television	Approved cable without additional protection	none
Overhead Paging	Approved cable without additional protection	16770
Nurse Call	Approved cable without additional protection	16761
Building Automation	Approved cable without additional protection	Division 17
Fire Alarm	Approved cable in rigid conduit	16721
Security	Approved BX cable or cable in rigid conduit	16727

D. Routing: All cable runs shall be routed to avoid passing near sources of electrical noise such as florescent fixtures, power converters, etc. Cable runs shall be routed to avoid paralleling high voltage or high amperage electrical wiring. Cable runs paralleling telephone cables shall have a minimum of twelve inch separation. The Architect will authorize waivers (in writing) for specific cases where the twelve inch separation cannot be maintained.

E. Horizontal Installation: Horizontal cable runs shall be installed per Section 16110, 3.01 using appropriate stringers, J-hooks, cable trays, and any other devices necessary so no cables above the ceiling shall lay on the ceiling, electrical conduit, ceiling suspension system, piping, ductwork or on any other systems installed in the area. The cable shall not be supported by any of the above mentioned systems. All cable shall be installed in a neat and orderly manner, above or well clear of existing systems. Cable shall not be installed below existing systems or attached to existing systems except on specific written wavier by the Architect.

F. Vertical Installation: All vertical cable runs shall be installed with appropriate strain reliefs.

G. Cable Identification: Identify all cable per Section 16010, 3.09 F. Wiring color code shall be approved in advance by the Architect and maintained throughout the scope of the work.

H. Record Drawings: Per Section 16010, 3.12, the Contractor shall keep accurate records of the cable installation and at the end of the Contract shall turn over to the Architect documentation

showing the routing and labeling of all cabling. The format of this documentation shall be approved by the Architect prior to beginning work.

I. Hazardous Materials: The Contractor shall not disturb any spray-on fire-proofing insulation on roof panels or supporting beams without the approval of the Architect and Owner. Some of this material contains asbestos and proper abatement procedures must be followed. Damage occurring to existing asbestos during the course of the work shall be repaired at the expense of the Contractor.

J. Wall and Floor Penetrations: All penetrations of smoke and fire walls and floors shall be the responsibility of the Contractor. Conduits and cables penetrating these walls and floors shall be sleeved according Section to 16110, 3.01L, and sealed per Section 16110, 3.04, both inside and out, with approved fire rated materials to prevent the passage of smoke. Fire and smoke penetrations caused by the removal of existing cable shall be properly sealed. The Contractor shall not penetrate any fire wall or structural member without specific authorization by the Architect.

K. Existing Finishes: The Contractor shall be responsible to repair any damage to the finishes (paint, wallcoverings, tile, carpet, ceiling tile, etc.) caused by the Contractor or his Subs in the areas where he is working.

L. Ceiling Tile: All ceiling tile removed by the Contractor for ceiling access shall be replaced at the end of each working day. Exceptions to this requirement must be approved by the Architect and Owner.

M. Equipment Installation: The Contractor shall not install equipment in any equipment room, closet, or in ceiling spaces without authorization from the Architect and Owner. All equipment shall be installed in NEMA enclosures. All wiring entering these enclosures shall be properly secured and protected.

N. Underground Installations: When installing or removing underground conduit installations, comply with Section 02200: Earthwork.

O. Cable Tests: All cables shall be tested by the Contractor to insure there are no grounds, opens or shorts. The tests shall be done as appropriate to the type cable being installed and as agreed between the Owner and Contractor. Any deficiency pertaining to these requirements shall be corrected by the Contractor prior to final functional and operational tests of the system with no charge to the Owner.

END OF SECTION

SECTION 16130 – OUTLET BOXES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Construction: Zinc-coated or cadmium plated sheet steel boxes of a class to satisfy the conditions at each outlet except where unilet or condulet bodies are required. Knockout type with knockouts removed are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4" octagon concrete rings and 4" octagon hung ceiling boxes with bars may be folded type; one-piece deep-drawn for all other boxes.

B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed six inches deep except where necessary to permit entrance of conduits into sides of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

C. Fixture Studs: 3/8" malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.

D. Exposed: Screw-joint type with gasketed weatherproof covers in locations exposed to the weather.

E. Tile Boxes: Rectangular in shape with square corners and straight sides for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls. Install without plaster rings.

F. Wall-Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified not less 4" square by 1-1/2" deep for 2 devices and multi-gang boxes for more than 2 devices. Boxes for switches and receptacles on unfinished walls may be screw-joint type with covers to fit the devices.

G. Wall-mounted Telephone Outlet Boxes: 4" square by 2-1/8" deep unless otherwise noted in the Drawings.

H. Light Fixture Boxes: 4" diameter by 1-1/2" deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3" diameter openings. Screw-joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits.

I. Grounding Terminal: Provide a grounding terminal in each box containing a green equipment ground conductor, or serving motors, lighting fixtures or receptacles. Grounding terminal shall be green colored washer-in-head machine screw or grounding bushing.

2.02 PULLBOXES:

A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets or pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion-resistant screw or bolt attachment.

PART 3 EXECUTION

3.01 OUTLET BOXES

A. Installation: Unless otherwise specified or shown on the Drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceiling of incombustible construction, not more than 1/4" back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plaster covers. Box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hanger, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work. Boxes shall be secured to metal studs with sheet metal screws. Metal stud clips, such as Caddy “MSF”, are not acceptable. All boxes shall have far side box supports installed similar to Caddy #766.

B. Mounting Heights: The mounting height of a wall-mounted outlet box shall be construed to mean the height from the finished floor to the horizontal centerline of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. The height of all outlets shall be at the same height when there is a secondary type wall construction along with the masonry construction. The height in the masonry construction shall be the governing factor. Verify exact height of all boxes with Architect.

C. Wall mounted switch, receptacle and signal outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to the trim. Install outlet boxes near the doors or the lock sides as shown on Architectural Drawings unless other locations are approved by the Architect.

3.02 PULLBOXES:

A. Provide additional pullboxes wherever necessary to meet requirements for maximum lengths of conduit runs and maximum numbers of bends as specified under "Conduit and Fittings".

3.03 FIXTURE CONNECTIONS:

A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2" flexible metallic conduits, 4 to 6 feet long with grounding provisions.

3.04 IDENTIFICATION:

A. Identify all exposed junction and pullboxes according to the system carried by means of painted-on stencils or labels with legible letters and contrasting colors without abbreviations. In general, use yellow color. Painting shall be in accordance with DIVISION - FINISHES.

END OF SECTION

SECTION 16133 - CABINETS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 GENERAL:

A. Sheet steel except those exposed to wet or rain conditions that shall be raintight unless otherwise noted. Cabinets without through feeder wiring shall be arranged to provide a wiring gutter not less than 4" wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by feeders in excess of 4/0, up to and including 750 MCM, shall be provided with top, bottom and side gutters 8" wide. Panelboard cabinets in all cases shall meet or exceed the minimum requirements of Article 373-6 of the National Electrical Code. Cabinets shall be of standard make and shall be equal in all respects to those bearing the Underwriters Laboratories label. Cabinets, including boxes shall be made of galvanized steel. All outside surfaces of trim and doors shall be given a factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard. Cabinet for telephone and communications systems shall have 5/8" exterior grade, one-face B-grade or equal plywood backboard inside with maximum height and width.

2.02 FEED THROUGH GUTTERS:

A. Where feeders go through panelboard cabinets to serve panelboards above or beyond, the wiring gutters in panelboard cabinets shall be a minimum of 8" on sides, top and bottom.

2.03 FRONTS:

A. One piece sheet steel frame and a hinged door with catch and lock for flush cabinets. Telephone and signal cabinets for surface mounting shall be equipped with a door hinged directly to cabinet. One piece sheet steel with 3/4" flange with all edges shaped to cover edge of box. Fronts may be secured to box by means of flathead screws with captive nuts or clamps.

2.04 DOORS:

A. Doors shall close against a rabbet placed all around the inside edge of the frame with a close fitting joint between door and frame. The doors shall be fitted with substantial flush hinges placed not over 24" apart, nor more than 6" from ends of doors, and fastened permanently to the door and frame with flat-headed rivets or spot welds, or with concealed flush piano hinges. Fastening screws of fronts shall be set not over 24" apart. Doors over 48" in height shall be equipped with a vault hinge and a three point catch.

2.05 DOOR-IN-DOOR:

A. Both surface and flush cabinets shall be door-in-door. The door over the interior of the cabinet shall be provided with hinges and combined lock and latch. The outside door over the cabinet gutters shall have a hinge on one side, and machine screws into threaded holes in the cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type cabinets shall have a 1/2" deep lip bent over all around, with the corners welded and grounded; or in the case of flush cabinets, a steel angle frame, equivalent in strength to the bent over lip, shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter. All locks shall be keyed alike.

2.06 LOCKS:

A. Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.07 GROUND BAR:

A. Each cabinet for a panelboard shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 EXECUTION

3.01 CABINETS:

A. Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6'-6" above floor and bottoms not less than 12" above floor. The height above floor of the highest over current device handle shall not exceed 6'-6".

END OF SECTION

SECTION 16140 – WIRING DEVICES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 SNAP SWITCHES:

A. Unless otherwise specified each snap switch (flush tumbler-toggle) shall be of the AC general use type for mounting in a single-gang spacing, fully rated 20 amperes, 120-277 volts, conforming to minimum requirements of the latest revision of the Underwriters Laboratories, Inc., UL 20, Fifth Edition, Standard Snap Switches and further requirements herein specified. Specification grade, heavy duty, single pole, three way or four way, of the maintained momentary or lock type as indicated on the Drawings. Ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts, AC 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publication WDI-1956, and shall be as follows unless otherwise noted:

20A120-277V AC	Hubbell	Bryant	P & S
1P	1221-I-IV	4901-I-IV	20-AC-1-I-IV
2P	1222-I-IV	4902-I-IV	20-AC-2-I-IV
3 way	1223-I-IV	4903-I-IV	20-AC-2-I-IV
4 way	1224-I-IV	4904-I-IV	20-AC-3-I-IV

2.02 RECEPTACLE

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publication WDI-1965, Part 3 and Part 10. Single or duplex as shown or noted on Drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacles shall be as follows:

Type	Hubbell	Bryant	P&S
Hospital Grade Duplex – 20 amp	8300-I	8300-I	9200-HGI
Spec. Grade Duplex - 15 amp	5262-I	5262-I	5262-I
Spec. Grade Duplex - 20 amp	5362-I	5362-I	5362-I
GFCI, Hospital Grade Duplex - 15 amp	GF-8200-I	GFR82FT-I	1591-FHGI
GFCI, Hospital Grade Duplex - 20 amp	GF-8300-I	GFR83FT-I	2091-FHGI
GFCI, Spec. Grade Duplex - 15 amp	GF-5262-I	GFR52-FT-I	1591-RI
GFCI, Spec. Grade Duplex - 20 amp	GF-5362-I	GFR53FT-I	2091-FI
Isolated Gnd., Orange, Spec. Grade Duplex - 15 amp	IG-5261	5261-IG	IG5266-SS
Isolated Gnd., Orange, Spec. Grade Duplex - 20 amp	IG-5361	5361-IG	IG5366-SS
Isolated Gnd., Orange, Hospital Grade Duplex - 15 amp	IG-8210	8210-IG	IG9201-HG
Isolated Gnd., Orange, Hospital Grade Duplex - 20 amp	IG-8310	8310-IG	IG9301-HG
Safety Receptacle, Duplex	SG-62HI	SG-62	SG-62

D. Special: Receptacles for special applications shall be as indicated on the Drawings.

2.03 PLUG CAPS:

A. Except for duplex receptacles and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles.

2.04 DEVICE PLATES

A. General: Provide device plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Plates shall be Stainless Steel unless otherwise noted.

1. Exposed: Plates for exposed joint fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium steel plates with gasket. Plates for cast type boxes at locations subject to wet or rain conditions shall be of cast, vapor tight type. Provide hinged lift covers for devices.

2. Communication: Plates for telephone and signal outlets shall each have a 3/8" bushed opening in the center. Wall plates for push-button and buzzer outlets shall have openings to suit the push buttons and buzzers.

3. Plates for special purpose outlets shall be of a design suitable for the particular applications.

2.05 CLOCK OUTLETS:

A. Flush, single receptacle, regressed in Stainless Steel device plate.

PART 3 EXECUTION

3.01 DEVICE PLATES:

A. Install with alignment tolerance of 1/16" and all edges in continuous contact with wall surfaces.

END OF SECTION

SECTION 16150 - MOTORS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 GENERAL:

A. Motors will be furnished with the equipment they are intended to operate and therefore generally will be furnished under other sections of these specifications. Furnish nameplates indicating manufacturer, horsepower, phase, cycle, voltage, RPM, type of motor windings, NEMA design and type of enclosure.

2.02 SIZE:

A. Adequate for the duty to be performed without exceeding their full rated load or safe operating temperature when the driven equipment is operating at specified capacities with ambient temperatures and altitude compensation simulating actual job conditions.

2.03 TYPE:

A. Suitable for the application but not less than Class A insulation and continuous duty classification, based on 40 degrees C. ambient temperature with drip proof frames and totally enclosed for exterior use. Conform to design, construction and performance requirements of NEMA and the Rotating Electrical Machinery Standards of ANSI.

2.04 VOLTAGE RATING:

A. NEMA Standard to correspond to circuit voltage serving the motor. Motors operating on 208 volt systems shall be rated 200 volts or shall be specifically wound for the voltage. Rated and covered by the plus or minus 10% rated voltage warranty for 208 volts.

PART 3 EXECUTION

3.01 INSTALLATION:

A. In accordance with related work specified in other sections of these Specifications and standard industry practice.

END OF SECTION

SECTION 16155 – MOTOR STARTERS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

1.02 SUBMITTALS:

A. Submit complete shop drawings, control diagrams and descriptive literature.

PART 2 PRODUCTS

2.01 GENERAL:

A. Starters shall be as specified in this section unless modified by other sections of these Specifications or by details or control diagrams on the Drawings. Provide NEMA Type I general purpose enclosures, unless otherwise noted or required, with doors arranged for padlocking. Equipment starters with contactors to break each ungrounded line to the motor. Starters shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer.

2.02 RATING:

A. Each starter shall have a horsepower rating not less than the rating of the motor it controls. Starters and all their related component parts shall be designed and properly coordinated for the rating and characteristics of the motors furnished under the various sections of the specifications. Motor starters and overcurrent devices shall be ambient temperature compensated.

2.03 OVERLOADS:

A. Provide ambient temperature compensated thermal overcurrent devices in each ungrounded phase. Provide a suitable reset device for resetting over current trip on the starter front. Overcurrent device ratings shall not exceed code maximums and shall be as recommended by the motor manufacturer for the application.

2.04 CONTROLS

A. Control circuit conductors shall be grounded in accordance with the NEC and shall be arranged so that an accidental ground will not start the motor.

B. Energy for control circuits and indicating lights shall be 120 volts.

C. Provide manual start-stop pushbuttons mounted in starter case unless automatic devices are shown elsewhere on Drawings or specified.

D. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for the purpose and have an adequate horsepower rating. When the automatic control device does not have such a rating, a magnetic starter shall be used, with the automatic control device actuating the pilot control circuit.

E. Starters controlled by automatic devices shall be provided with hand-off-automatic selector switch mounted on starter case and connected so motor can be manually operated regardless of the position of the automatic control device. Selector switch shall not be connected to supersede any safety device or safety interlock.

F. Provide starters with a sufficient number of auxiliary contact (N.O. and/or N.C.) to afford the control and interlocking required. Provide additional relays if required to obtain the correct control.

PART 3 EXECUTION

3.01 GENERAL:

A. Provide each motor with a motor starter of proper design to meet the requirements of the motor and drive.

3.02 INSTALLATION:

A. Install and connect in accordance with related work specified in other sections of these Specifications and standard industry practice.

END OF SECTION

SECTION 16160 - PANELBOARDS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Cabinets: Section 16133.

D. Motor and Circuit Disconnects: Section 16170.

E. Fuses: Section 16181.

F. Grounding: Section 16450.

1.02 SUBMITTALS:

A. Submit complete shop drawings with outline dimensions, descriptive literature and complete description of the frame size, trip setting, class and interrupting rating of all overcurrent devices. Identify available space.

PART 2 PRODUCTS

2.01 GENERAL:

A. Dead front, safety type with voltage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings. Panelboards shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer and shall be circuit breaker or fusible type as scheduled.

2.02 CABINETS:

A. Each panelboard shall be enclosed in a single sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 16133, Cabinets.

2.03 DOOR-IN-DOOR:

A. Both surface and flush panels shall be door-in-door. The door over the interior of the panel shall be provided with hinge and combined lock and latch. The outside door over the panel gutters shall have a hinge on one side and machine screws into threaded holes in the panelboard cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type panels shall have a 1/2" deep lip bent over all around with the corners welded and ground; or, in the case of flush panels a steel angle frame, equivalent in strength to the bent over lip shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter or as required by NEC All locks shall be keyed alike.

2.04 BREAKERS:

A. Molded-case or combination molded-case and current limited fuses as scheduled or required. Provide quick make and quick break toggle mechanism, inverse time trip characteristics and trip

free operation on overload or short circuit. Automatic tripping shall be indicated by a handle position between the manual OFF and ON position. Provide a trip element for each pole, a common trip bar for all poles and a single molded insulating material handle. Handle ties will not be accepted. Adjustable magnetic trip devices shall be set at the factory to the low trip setting. Provide breaker frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger.

2.05 BOLTED TYPE:

A. Circuit breaker current-carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for three-phase, four wire mains, unless otherwise indicated on the Drawings.

2.06 FUSIBLE SWITCH UNITS:

A. Quick make, quick break type with external operation handle suitable for padlocking in OFF position. Provide interlock to prevent opening cover when switch is in ON position unless interlock release is operated. Provide switch frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger. Fusible panelboards shall be UL rated and listed for service entrance where applicable.

2.07 SPACE ONLY:

A. Where "Space Only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device.

2.08 DIRECTORIES:

A. Provide circuit directories on the inside face of the door of each panel.

2.09 LABELS:

A. Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws or phenolic buttons or small window frame type. Adhesive stick on labels alone will not be acceptable unless specifically approved.

2.10 SKIRTS:

A. Where noted on the Drawings panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

PART 3 EXECUTION

3.01 DIRECTORIES:

A. Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the Drawings inserted in plastic holder. Text shall be able to be read entirely without moving the card.

3.02 CIRCUIT NUMBERING:

A. Circuit numbering shown on the Drawings is based on pole position in the panelboard and not consecutive numbering.

3.03 PHASE ROTATION:

A. Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION

SECTION 16170 – MOTOR AND CIRCUIT DISCONNECTS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

PART 2 PRODUCTS

2.01 DISCONNECTING MEANS

A. Safety Switches: Fusible or non-fusible Type HD quick break safety switches of the sizes and capacities indicated or required. Raintight enclosures at locations exposed to the weather.

B. Separately Enclosed Motor Snap Switches: Motor snap switches may be used for motor disconnect means, controller and motor overcurrent protection when applicable. These devices shall be horsepower rated and may contain motor running overcurrent protection.

C. Safety Type Disconnecting Switches: Heavy duty, quick make, quick break type, 250 or 600 volt rating as required for the application. Number of poles and ampacity as noted or required by code. Fusible where noted with fuse clips suitable for Buss Fusetron Class R Fuses. Short circuit rating of 200,000 RMS Amperes with CV Class R rejection feature installed in fuseholders. NEMA 1 enclosures for dry locations. NEMA 3 R enclosures for wet locations or at exposed weather locations unless otherwise noted.

2.02 MANUFACTURERS

A. General Electric, ITE, Square D, or Cutler-Hammer.

PART 3 EXECUTION

3.01 DISCONNECT MEANS:

A. Install in each location indicated on the Drawings and elsewhere as required by NEC.

END OF SECTION

SECTION 16181 - FUSES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Motor and Circuit Disconnect: Section 16170.

D. Grounding: Section 16450.

PART 2 PRODUCTS:

2.01 FUSES

A. General: Dual element, time delay type, based on heavy service, Buss Fusetron, or equal, unless otherwise noted or required for installation.

B. Current Limiting Fuses: Provide where indicated on the Drawings. For individual motor circuit protection, provide fuse sized approximately 125 percent of full load current with 100,000 amperes interrupting capacity. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L fuses sized 125 percent of load current or as required for coordination with air and molded case circuit breakers, shall be furnished by the circuit breaker manufacturer.

C. Above 600 amps; Class L, "Hi-Cap" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

D. Below 600 amps, as required by short circuit duty, Class K-1, "Limitron" or class K-5, "Low Peak" or Class K-5, "Fusetron" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

E. All switches having current limiting fuses installed shall have a Lamicoid nameplate with white lettering on red background reading:

WARNING, REPLACE ONLY WITH CURRENT
LIMITING FUSES AS ORIGINALLY INSTALLED

2.02 COORDINATION:

A. Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

PART 3 EXECUTION

3.01 COORDINATION:

A. Coordinate the low voltage fuses required for the project to provide basic selection protection and properly coordinate with the other associated protective equipment.

3.02 SPARE FUSES:

A. Furnish one complete spare set of each size of fuses. Deliver to the Owner in the original boxes. It shall consist of 100% fuse replacement for all fuses required for panelboards and safety switches.

END OF SECTION

SECTION 16450 - GROUNDING

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Raceways: Section 16110.

D. Outlet Boxes: Section 16130.

E. Wires and Cables: Section 16120.

F. Wiring Devices: Section 16140.

G. Cabinets: Section 16133.

H. Motor and Circuit Disconnects: Section 16170.

I. Panelboards: Section 16160.

PART 2 PRODUCTS

2.01 Materials, equipment and devices related to the grounding system are specified under other sections of these Specifications.

PART 3 EXECUTION

3.01 GENERAL:

A. Install two separate grounding systems, a service grounding system and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the Drawings or as specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry-type transformers.

3.02 SERVICE GROUNDING SYSTEM

A. General: The service grounding system is provided for the AC service neutral ground. Current return conductors, such as neutrals of the service entrance, feeder circuits and branch circuits, shall not be used for equipment grounding. Care must be exercised to insure that neutral bars are not bonded to the enclosures of panelboards, etc., which are not part of the main service equipment. Except for separately derived systems, the neutral conductors shall be grounded only in the main service equipment.

B. Common Ground Point: Establish one common ground point in the main service equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment ground bus (or bar), and service grounding electrode conductor.

C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service equipment for disconnecting and isolating the neutral bus from the common ground. The disconnecting means may be disconnecting links in the interconnection between the insulated neutral and uninsulated equipment ground.

D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc., which have neutral connections.

3.03 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the Drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current-carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current-carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground box (or bar) with a conductor or bar sized for 50% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all panelboards, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in panelboards or a separately mounted bar adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the Drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor installed.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings and other fixed equipment.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center or separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.04 SEPARATELY DERIVED SYSTEMS:

A. Transformers creating separately derived distribution systems, such as dry type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.05 GROUNDING ELECTRODES:

A. Two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth (NEC 250-H). Make the connections to the cold water pipe inside the building at the point of entrance. The grounding electrode for separately derived systems shall be approved for the application.

3.06 GROUNDING CONDUCTORS:

A. The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250-94, including the conductor for the made electrode. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and the most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards of transformers the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal sheathed holes. All connections shall be available for inspection and maintenance.

3.07 GROUND CONNECTIONS:

A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with "Galvanoz", or equal.

3.08 TESTS

A. Remove all jumpers between the equipment ground busses and the service (neutral) ground busses in the main service panel and all separately derived systems. See Section 3.02.C.

B. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel where the jumper was installed. The resistance shall be greater than 10 megohms.

C. Re-connect the equipment and service bus jumpers on all systems. See Section 3.02.C.

D. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel farthest away (electrically) from the panel where the jumper was installed. The resistance shall be less than 5 ohms.

E. Submit a written report to the Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Architect.

END OF SECTION

SECTION 16500 – LIGHTING EQUIPMENT

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Grounding: Section 16450.

D. Lamps: Section 16501.

E. Ballast and Accessories: Section 16502.

F. Fluorescent Fixtures: Section 16511.

1.02 SUBMITTALS

A. Submit for approval complete shop drawings, catalog cut, special installation instruction, photometric data, descriptive literature, and actual fixture when requested by Architect.

B. Each fixture submittal shall be inclusive of lamp manufacturer's data for lamp to be furnished for each particular fixture. Review of fixtures will not be started until this provision has been met.

1.03 PRIOR APPROVAL:

A. All proposed substitutions to the specified fixtures shall be submitted for approval a minimum of 10 calendar days prior to bid opening. The submittal for approval shall include all data called for in submittals along with an actual fixture proposed to be substituted. When a substitution is accepted as an equal and the substituted fixture is awarded for this Contract as the fixture to be furnished, then the substituted fixture may be retained by the Contractor and shall be the last fixture of that type to be installed on this project. All of the same type fixtures shall be equal to or better than that fixture retained.

PART 2 PRODUCTS

2.01 GENERAL:

A. Furnish all lighting fixtures throughout of the type indicated on the drawings, complete with lamps, sockets, wiring, fitters, hangers, plaster rings, canopies, etc., as required.

2.02 METAL HALIDE FIXTURES:

A. All metal halide fixtures shall be provided with a clear glass lens integral to fixture.

2.03 RECESSED FIXTURES

A. All recessed fixtures shall be provided with thermal protection as required by National Electrical Code.

PART 3 EXECUTION

3.01 SUPPORTS:

A. Support ceiling fixtures by anchorage to the ceiling only where the ceiling is concrete or masonry units. For ceiling of other construction, anchor ceiling fixtures to metal or wood supports provided for the purpose, of suitable strength and stability, adequately attached to and supported by joists, trusses or other structural members, unless other methods of support are specifically approved by the Architect. Where lay-in construction is used fixtures shall be of the lay-in type. Fixtures shall be supported at all four corners to structure above. Coordinate supports for lay-in fixtures with ceiling Installer/Sub-Contractor.

3.02 LOW DENSITY CEILING:

A. Special attention is directed to the code restriction against mounting fluorescent fixtures on combustible low density cellulose fiberboard ceilings (NEC 410-77b). If fixtures are to be installed that are not UL approved for this condition a suitable mounting arrangement shall be developed which meets the approval of the Architect.

3.03 CEILING TRIM AND MEANS OF SUPPORT:

A. The ceiling trim and means of support of recessed fixtures shall be coordinated with the type of ceiling to be installed within or on to insure proper installation.

3.04 SUSPENDED FIXTURES:

A. Provide swivel hangers and canopies to insure a plumb installation. For single unit suspended fluorescent fixtures provide tubing or stems for wiring at one point and a tubing or rod suspension provided for each unit of chassis. Provide 3/16" diameter rods minimum.

3.05 BLOCKING:

A. Protect housing of recessed lighting fixtures during installation by internal blocking or framing to prevent distortion of sides or dislocation of threaded lugs which upon completion must be in perfect alignment and match the corresponding holes in frames or rims so that holding screws can be installed freely without forcing and remain so they can be easily removed when servicing. Threads to receive holding screws shall be chased after plating and finishing to insure easy installation and removal of knurled headed screws by thumb pressure.

3.06 LAMP GUARDS:

A. Provide wire guards on open type fluorescent fixtures to prevent lamps from falling.

3.07 CLEAN UP:

A. At final inspection the fixtures and lighting equipment shall be in first class operating order, in perfect condition as to finish, free from defects, completely lamped, clean and free from dust, plaster or paint spots, and complete with the required glassware, reflectors, side panels, louvers or other components necessary to complete the fixtures.

3.08 CEILING TRIM:

A. Furnish proper ceiling frames for the ceiling material in which recessed fixtures are to be installed, verify prior to ordering. Rims of all fixtures that overlap ceilings shall be installed tight and snug against the ceiling surfaces so that no light leakage occurs around the rim. If unevenness or surface of fixture allows light to show, then this contractor shall provide soft sponge filler or gasket on all fixtures requiring this treatment, and as approved by Architect.

3.09 FIXTURES

A. Special attention is directed to the special provisions for flush and recessed fixtures in the National Electrical Code.

1. All recessed fixtures shall have top connections to the outlet boxes installed in accordance with the code.

2. Connection to lay in fixtures shall be made with flexible connections of 4'-0" minimum, 6’-0” maximum length. Fixture-to-fixture wiring is not permitted.

3. All recessed fixtures shall be furnished with UL listed thermal protective device.

END OF SECTION

SECTION 16501 - LAMPS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. Grounding: Section 16450.

C. Lighting Equipment: Section 16500.

D. Ballast and Accessories: Section 16502.

PART 2 PRODUCTS

2.01 FLUORESCENT LAMPS:

A. Fluorescent lamps shall be GE 3000 degree K/SP30 or approved equal, energy saving lamps matched for usage to energy saving ballast. The ballast/lamp system shall be capable of providing 6000 initial lumens for two lamps with 75 watts system input.

2.02 INCANDESCENT LAMPS:

A. Incandescent lamps shall be inside frosted, medium base, extended service, 130 volt unless otherwise noted. PAR or R lamps shall be provided if called for on the Drawings.

2.03 MERCURY VAPOR LAMPS:

A. Mercury vapor lamps shall be Deluxe white phosphor coated, mogul base with correlated color temperature of 3900 degree K or as indicated.

2.04 METALLIC HALIDE LAMPS:

A. Metallic halide lamps shall be phosphor coated, mogul base and shall be furnished for proper lamp burning position as determined by fixture installed within. Correlated lamp color temperature shall be as follows:

100 watt 3200 degrees K
175 watt 3200 degrees K
250 watt 3200 degrees K
400 watt 3700 degrees K
1000 watt 3400 degrees K

Color temperature may vary 100 degrees K plus or minus.

2.05 HIGH PRESSURE SODIUM LAMPS:

A. High pressure sodium lamps shall be clear, mogul base with an apparent color temperature of 2100 degree K, or as indicated. Lamps shall be furnished for proper lamp burning position as determined by fixture installed within.

2.06 SAFETY:

A. All Mercury Vapor and Metallic Halide Lamps shall be furnished with a means of immediately extinguishing the lamp when the outer lamp envelope is either penetrated or broken.

2.07 MANUFACTURERS:

A. General Electric, Sylvania, or Cutler-Hammer are approved. Where a specific manufacturer's product is mentioned, then it shall be so furnished.

PART 3 EXECUTION

3.01 INSTALLATION:

A. The Contractor shall install new lamps in all lighting fixtures. Installation of the new lamps shall be made seven (7) days before final inspection, unless otherwise approved by the Architect in writing.

END OF SECTION

SECTION 16502 – BALLASTS AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. Grounding: Section 16450.

C. Lighting Equipment: Section 16500.

D. Lamps: Section 16501.

PART 2 PRODUCTS

2.01 GENERAL: Ballast shall be supplied for the voltage that the fixture is connected to. All ballast shall be high power factor and UL listed.

A. Ballasts: Fluorescent ballasts shall be energy savings type and shall be usable with energy savings lamps so that the ballast/lamp system shall be capable of providing 6000 average initial lumens for two lamps at 75 watts of system input. Ballast performance with such lamps shall be certified by ETL or approved equal laboratory with a United States Government Registered Certification Mark for fluorescent lamp ballast. Performance certification with such lamps shall be according to component test method and appear on ballast nameplate; the relative light output shall be 95% with a tolerance of +5% to -2-1/2% and input watts shall be 78 watts with a tolerance of 5%. The ballast case temperature shall not exceed 90 degree C. Ballast shall be UL listed, Class P, Premium. Mercury vapor, metal halide, and high-pressure sodium ballasts shall be manufactured with the following features:

1. .125 minimum thickness extruded aluminum housing with heat dissipating fins.

2. Die cast aluminum end cap closure.

3. Thermally isolated capacitor enclosed in a diecast compartment with easy access for serviceability.

4. Constant auto stabilized, high-power factor.

5. Constant Wattage, auto-stabilized, high power factor. Core and coil encapsulated in a thermally conductive Class F (155 degree C.), insulation material which isolates sound attenuating vibration.

6. Stand-By feature with instant incandescent light from energizing or re-energizing of current to 70% of rated output of HID lamp.

2.02 MANUFACTURERS:

A. Advance, General Electric, Jefferson, Universal, Halo, Prescolite, or approved equal for function specified.

PART 3 EXECUTION

3.01 All ballasts shall be installed within specific fixtures in a manner so as to assure a completely silent operation with attainment of maximum ballast life as specified by the manufacturer.

END OF SECTION

SECTION 16511 – FLUORESCENT FIXTURES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Raceways: Section 16110.

D. Grounding: Section 16450.

E. Lighting Equipment: Section 16500.

F. Lamps: Section 16501.

G. Ballasts: Section 16502.

1.02 SUBMITTALS:

A. Submit complete shop drawings indicating construction of fixture including lens nominal thickness, photometry's and housing thickness.

PART 2 PRODUCTS

2.01 FLUORESCENT FIXTURES:

A. All fixtures, ballasts and supports shall be quiet in operation. Louvers, shields, reflectors and all sections of the channel structure shall be securely held in position. Fixtures shall not be mounted in such a way that ballast hum will be amplified or transmitted into work areas.

2.02 FINISH:

A. Bonderized or equal treatment on all steel parts prior to applying finish. Metal parts shall be aluminum, brass, copper, bronze or steel, with baked white enamel finish unless otherwise noted on the drawings.

2.03 FLUORESCENT LAMPHOLDERS:

A. Designed so lamps will be held firmly in place, electrically and mechanically permitting easy insertion or removal of lamps. Provide corrosion resistant, silver plated lamp pin contacts.

2.04 LENS:

A. When an acrylic lens or diffuser is specified it shall be molded of 100% Acrylic meeting American Society for Testing materials specifications for Methacrylate Molding and Extrusion Compounds (ASTM D788-63). Plastic diffusing panels, luminous side panels and other luminous plastic members of fixtures shall be made of not less than nominal .125" thick prismatic clear acrylic material. Plastic shall be nonflammable or shall have a flame spread rate of not more than 3.2 inches per minute for a 1/2" width of the material. The plastic shall show no yellowing apparent to

the naked eye either when subjected to the accelerated weathering test in accordance with ASTM D795-44T (500 hours exposure, using type S-1 lamp) or after prolonged exposure to a fluorescent lamp source under conditions identical with those existing in the fixture in which it is to be used. The plastic shall be non-electrostatic or the finished parts shall be treated with an anti-static wax.

B. HOUSING: Not less than 20 gauge steel with baked white enamel finish applied over corrosion resistant primer unless otherwise specifically approved.

PART 3 EXECUTION

3.01 LAY-IN FIXTURES:

A. All lay in fixtures shall be adequately supported on all four corners to the structure and not to the ceiling alone.

3.02 SURFACE MOUNTED FIXTURES:

A. All surface mounted fixtures shall be furnished with top plates whenever applicable.

END OF SECTION

SECTION 16722 – FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and shall monitor the integrity of all conductors.

C. The fire alarm system shall comply with requirements of Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.02 SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance with the specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Style 7 (Class A) signaling line circuit.

2. Initiation device circuits shall be wired Class A (NFPA Style D).

3. Indicating appliance circuits shall be wired Style Z (Class A).

4. Digitized electronic signals shall employ check digits or multiple polling.

5. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

C. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1. The System Alarm LED shall flash.

2. A local piezo electric signal in the control panel shall sound.

3. The 80 character LCD display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and it's location within the protected premises.

4. Printing and history storage equipment shall log the information associated each new Fire Alarm Control Panel condition, along with time and date of occurrence.

5. All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.

1.03 SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.

2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance.

B. Shop Drawings:

1. Sufficient information, clearing presented, shall be included to determine compliance with drawings and specifications.

2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manual listing the manufacturer's name(s) including technical data sheets.

2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.

3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.04 GUARANTY: All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.05 APPLICABLE SPECIFICATIONS: The specifications and standards listed below form a part of this specification. The system shall fully comply with these standards.

A. National Fire Protection Association (NFPA) - USA:

No. 12	CO2 Extinguishing Systems
No. 12A &B	Halon Extinguishing Systems
No. 15	Water Spray Systems

No. 16	Foam/Water Deluge and Spray Systems
No. 70	National Electrical Code (NEC)
No. 71	Central Station Signaling Systems
No. 72	Protective Signaling Systems
No. 72E	Automatic Fire Detectors
No. 72G	Notification Appliances for Protective Signaling Systems
No. 72H	Testing Procedures for Signaling Systems
No. 101	Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 346	Waterflow Indicators for Fire Protective Signaling Systems.
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Indicating Appliances

C. Local and State Building Codes:

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.06 APPROVALS

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories Inc.
FM	Factory Mutual
ULC	Underwriters Laboratories Canada

B. The system shall be listed by the national agencies as suitable for extinguishing release applications.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.

2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40% of interior cross sectional area where three or more cables are contained within a single conduit.

3. Cable must be separated from any open conductors of Power, or Class I circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.

4. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.

5. Conduit shall be ½ inch minimum.

B. Wire:

1. All fire alarm system wiring shall be new.

2. Wiring shall be in accordance with local, state, and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Indicating Appliance Circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically excepted by the fire alarm equipment manufacturer. The system shall permit use of IDC and IAC wiring in the same conduit with the communication loop.

5. All field wiring shall be completely supervised.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL Listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.03 MAIN FIRE ALARM CONTROL PANEL

A. The FACP shall be a NOTIFIER Model AFP-200, and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. System Capacity and General Operation:

1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices plus 103 control circuits.

2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LED's, and an alphanumeric keypad for the Field Programming and Control of the Fire Alarm System.

3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.

4. The FACP shall provide the following features:

Drift Compensation to extend detector accuracy over life.
Sensitivity Test, meeting requirements of NFPA 72E.
Maintenance Alert to warn of excessive compensation.
System Status Reports to display or printer.
Alarm Verification, with verification counters.
PAS presignal, meeting NFPA 72 requirements.
Rapid manual station reporting (under 2 seconds).
Non-Alarm points for general (non-fire) control.
Periodic Detector Test, conducted automatically by software.
Pre-alarm for advanced fire warning.
Counting "cross-zone" options.
March time and temporal coding options.
Walk Test, with check for two detectors set to same address.
Security Monitor Points, meeting requirements of UL 1076.
Control-By-Time for non-fire operations, with holidays.
Day/Night automatic adjustment of detector sensitivity.
Device Blink Control for sleeping areas.

C. Central Microprocessor:

1. The Microprocessor Unit shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage; non-volatile memory for building-specific program storage; and a "watch dog" timer circuit to detect and report microprocessor failure.

2. The Microprocessor Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

3. The Microprocessor Unit shall also provide a real-time Clock for time annotation of system displays, printer, and history file. The Time-Of-Day and date shall not be lost if system primary and secondary power supplies fail. The real-time Clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. Display:

1. The Display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

2. The Display shall include status information and custom alphanumeric labels for all Intelligent Detectors, Addressable Modules, and Software zones.

3. The Display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LED's), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.

4. The Display shall provide a 21-key touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

5. The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

E. SLC Loop Interface:

1. The SLC Interface shall provide power to, and communicate with, all of the Intelligent/ Addressable Detectors and Addressable Modules over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.

2. The Loop Interface Board shall receive analog information from all Intelligent Detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

3. The detector software shall meet NFPA 72E requirements and be certified by UL as a calibrated sensitivity test instrument.

4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:

1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided.

2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.

3. The EIA-485 port for the serial connection of the optional Annunciators and remote LCD displays shall be provided.

4. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.

G. Enclosures:

1. The control panel shall be housed in a UL Listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

H. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

I. Optional plug-in modules shall be provided for NFPA 72B and NFPA 72C transmitters.

J. Power Supply:

1. The Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

2. It shall provide 5.0 amps of usable indicating appliance power, using a switching 24 VDC regulator.

3. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.

4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.

5. It shall be power-limited using Positive Temperature Coefficient (PTC) resistors.

6. It shall provide optional meters to indicate battery voltage and charging current.

K. Field Wiring Terminal Blocks: For ease of service, all wiring terminal blocks for I/O interfaces shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks permanently fixed or mounted are not acceptable.

L. Operators Controls:

1. Acknowledge Switch:

a. Activation of the control panel Acknowledge switch in response to new Alarm and/or Trouble shall silence the local panel piezo electric signal and change the Alarm and Trouble LED’s from flashing mode to steady-ON mode. If multiple Alarm or Trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next Alarm or Trouble condition.

b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Signal Silence Switch: Activation of the Signal Silence Switch shall cause all programmed Alarm Indicating Appliances and relays to return to the normal condition after an alarm condition. The selection of indicating circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. System Reset Switch: Activation of the System Reset Switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition. Holding the RESET switch shall perform a Lamp Test function.

4. Drill (Evacuate) Switch: Press and hold of the Drill Switch shall activate all Indicating Appliance circuits. The Drill function shall latch until press of Signal Silence or Reset.

2.04 SYSTEM COMPONENTS

A. Electronic Chimes:

1. Electronic chimes shall operate on 24 VDC nominal.

2. Electronic chimes shall have field-selectable choice of single-stroke or vibrating operation, with sound level adjustable to 83 dBA at 10 feet and chime tone adjustable from 800 to 1200 Hz.

3. Shall be flush or surface mounted as shown on plans.

4. Shall be placed 80 inches (2,030 mm) above the highest floor level within the space, or 6 inches (152 mm) below the ceiling, whichever is lower.

B. Strobe Lights:

1. Shall operate on 24 VDC nominal.

2. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:

a. Unless otherwise specified on the drawings, the intensity shall be a minimum of 117 candela.

b. The flash rate shall be a minimum of one flash per second at 24 VDC.

c. The appliance shall be placed 80 inches (2,030 mm) above the highest floor level within the space, or 6 inches (152 mm) below the ceiling, whichever is lower.

d. The strobes shall be for vertical sidewall mounting only with the clear lens window at the lower part of the lens lettering properly reading vertically.

C. Electronic Chime/Strobe Combination Devices:

1. Shall meet the requirements of individual units listed above.

D. Addressable Manual Stations:

1. Addressable Manual Stations shall be provided to connect to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops. Up to 99 addressable manual stations may be connected to one SLC loop.

2. The Manual Station shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. Manual Fire Alarm Stations shall use a key operated test-reset lock, and shall be designed so that after actual Emergency Operation, they cannot be restored to normal use except by the use of a key.

3. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key.

4. Manual Stations shall be constructed of painted die-cast metal, with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters. Model RS-IT-KL.

5. Stations shall be suitable for surface mounting, or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, or more than 48 inches above the finished floor.

6. The Manual Station shall be addressable.

E. Intelligent Photoelectric Smoke Detectors:

1. Smoke detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuit loops. Up to 99 intelligent detectors may connect to one SLC loop.

2. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

3. The detectors shall be ceiling-mount and shall include a twist-lock base.

4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

5. The detector shall provide address-setting means on the detector head using decimal switches. Because of the possibility of installation error, systems that use binary jumpers on dip-switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector.

6. The detectors shall provide dual alarm and power LED’s. Both LED’s shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED’s may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LED’s shall be controlled

through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.

7. The detector sensitivity shall be set through the Fire Alarm Control Panel, and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.

8. using software in the FACP, the detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72E.

9. Install detectors where shown or noted on drawings.

F. Intelligent Ionization Type Smoke Detectors:

1. Smoke Detectors shall be Intelligent and Addressable, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits. Up to 99 intelligent detectors may connect to one SLC loop.

2. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

3. The detectors shall be ceiling-mount and shall include a twist-lock base.

4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.

5. The detectors shall provide address-setting means on the detector head using decimal switches. Because of the possibility of installation error, systems that use binary jumpers or dip-switches to set the address are not acceptable. They shall also store an internal identifying code that the control panel shall use to identify the type of detector.

6. The detectors shall provide dual alarm and power LED’s. Both LED’s shall flash under normal conditions. In certain applications, LED’s may be selected to be polled without flashing through system programming. Both LED’s may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

7. The detector sensitivity shall be set through the Fire Alarm Control Panel, and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted to the panel on a time-of-day basis.

8. using software in the FACP, the detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72E.

9. Install detectors where shown or noted on drawings.

Intelligent Heat Detectors:

1. Heat Detectors shall be Intelligent and Addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits. Up to 99 intelligent heat detectors may connect to one SLC loop.

2. The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

3. The detectors shall be ceiling-mount and shall include a twist-lock base.

4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

5. The detectors shall provide address-setting means on the detector head using a decimal switch. Because of the possibility of installation error, systems that use binary jumpers or dip-switches to set the address are not acceptable.

6. The detectors shall provide dual alarm and power LED's. Both LED's shall flash under normal conditions. In certain applications, LED's may be selected to be polled without flashing through system programming. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

7. An output connection shall also be provided in the base to connect an external remote alarm LED.

8. Install detectors where shown or noted on drawings.

H. Intelligent In-duct Smoke Detector Housing:

1. In-Duct Smoke Detector Housing shall accommodate either an intelligent Ionization sensor or a Intelligent Photoelectric Sensor, either of that provides continuous analog monitoring and alarm verification from the panel.

2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of isolation of toxic smoke and fire gases throughout the areas served by the duct system.

I. Monitor Module:

1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any NO dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.

2. The Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box.

3. The IDC zone may be wired for Style D or Style B operation. The Monitor Module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Fire Alarm Control Panel (FACP) shall use to identify

the type of device. Modules that use binary jumpers or dip-switches are subject to installation errors and are not acceptable. A LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

4. For difficult to reach areas, the Monitor Module shall be available in a miniature package and shall be no larger than 2-3/4" x 1-¼" x ½". This version need not include Type D or a LED.

J. Control Module:

1. Addressable Control Modules shall be provided to supervise and control the operation of one conventional Indicating Appliance Circuit (IAC) of compatible, 24 VDC powered, polarized Audio/Visual Indicating Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.

2. The Control Module shall mount in a standard 4-inch square, 2-1/8" deep electrical box, or to a surface mounted backbox, or directly in the Fire Alarm Control Panel.

3. The IAC may be wired for Style Z or Style Y IAC (Up to 1 Amp of Inductive A/V Signal, or 2 Amps of Resistive A/V Signal) operation, or as a Dry Contact (Form C) Relay. the relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or IACs may be energized at the same time on the same pair of wires.

4. Audio/Visual Power shall be provided by a separate supervised Power Loop from the main Fire Alarm Control Panel or from a supervised, UL listed Remote Power Supply.

5. The Control Module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Control Panel shall use to identify the type of device. Modules that use binary jumpers or dip-switches are subject to installation errors and are not acceptable. A LED shall be provided that shall flash under normal conditions, indicating that the Control Module is operational and is in regular communication with the Control Panel.

6. A magnetic test switch shall be provided to test the module without opening or shortening it's IAC wiring.

K. Isolator Module:

1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.

2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section of the SLC loop.

3. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after it's normal operation.

4. The Isolator Module shall mount in a standard 4-inch deep electrical box, in a surface mounted backbox, or in the Fire Alarm Control Panel. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

L. Water Flow Switches:

1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.

2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.

3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

4. Flow switches shall be provided and connected under this section and installed by mechanical contractor.

M. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

2. Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.

3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The mechanism shall be contained in a weatherproof aluminum housing, that shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.

5. Switch housing to be finished in red baked enamel.

6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

N. LCD Alphanumeric Display Annunciator:

1. The Alphanumeric Display Annunciator shall be a supervised, local or remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.

2. The LCD Annunciator shall display all alarm and trouble conditions in the system.

3. The Annunciator shall connect to an EIA 485 interface.

4. Up to 4 LCD annunciators may be connected to the interface, each with Acknowledge, Silence and Reset controls for the FACP.

2.05 BATTERIES

A. Shall be 12 volt, Gel-Cell type (two required).

B. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

C. The batteries are to be completely maintenance-free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is on-going during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.02 TEST: Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

3. Verify activation of all flow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.

5. Open and short signaling line circuits and verify that the trouble signal actuates.

6. Open and short indicating appliance circuits and verify that trouble signal actuates.

7. Ground all circuits and verify response of trouble signals.

8. Check presence and audibility of tone at all alarm notification devices.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.

10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grounded devices, sensitivity monitoring, verification functionality and similar.

3.03 FINAL INSPECTION: At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.04 INSTRUCTION

A. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the Owner.

END OF SECTION

SECTION 16740 – TELEPHONE SYSTEM

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Special Conditions and General Requirements apply to the work specified in this section.

B. General Provisions: Section 16010.

C. Raceways: Section 16110.

D. Wires and Cables: Section 16120.

E. Outlet Boxes: Section 16130.

F. Wiring Devices: Section 16140.

G. Cabinets: Section 16133.

H. Motor and Circuit Disconnects: Section 16170.

I. Panelboards: Section 16160.

J. Grounding: Section 16450.

1.02 TELEPHONE SYSTEMS, GENERALLY

A. The telephone system shall be as indicate on the drawings and as specified.

B. Conduit feeder connects from the main telephone equipment board to the service point location as coordinated with the local telephone company. Conduit branches connect the telephone outlets to the terminal boards.

PART 2 PRODUCTS

2.01 GENERAL:

A. Cabinets, outlet boxes, device plates, conduit, pull wires, etc. shall be as indicated on the drawings and specified elsewhere in these specifications.

PART 3 EXECUTION

3.01 CONDUIT and WIRING:

A. Install in accordance with Sections 16110 and 16120.

3.02 PULL WIRES:

A. Install pull wire in each telephone conduit.

3.03 GROUND:

A. Continuous No. 6 ground at bottom of terminal board or cabinet with No. 6 ground wire in 1/2 inch conduit to the building grounding system.

3.04 CONDUIT STUBS:

A. Stub feeder conduits to the left side of the terminal board and branch conduits to the right side of the terminal board unless otherwise noted.

3.05 DUPLEX RECEPTACLES:

A. Locate continuous wiremold plugmold receptacle strip at the bottom of the board, above ground, with devices at 12" O.C., unless otherwise noted.

3.06 COORDINATION:

A. Details, exact locations and arrangement of the telephone facilities shall be coordinated with and as recommended and approved by Mountain Bell. This includes the location and orientation of receptacles, service entrance conduits and conduit stubs in the equipment room.

END OF SECTION

TECHNICAL SPECIFICATIONS

List of Specifications related to the building.

3300 CAST IN PLACE CONCRETE
4200-UNIT MASONRY
4711-MANUFACTURED STONE VENEERS
6100 ROUGH CARPENTRY
6192 WOOD TRUSSES
6201 EXTERIOR FINISH CARPENTRY
6402 INTERIOR ARCHITECTURAL WOODWORK
7050 WEATHER BARRIERS
7210 BUILDING INSULATION
7410 METAL ROOFING - R-PANEL
7411 MANUFACTURED ROOF PANELS
7460 SIDING
7530 SINGLE-PLY MEMBRANE ROOFING
7600 FLASHING AND SHEET METAL
7720 ROOF ACCESSORIES
7901 JOINT SEALANTS
8111 STEEL DOORS AND FRAMES
8211 WOOD & PLASTIC DOORS
8360 SECTIONAL OVERHEAD DOORS
8410 ALUMINUM ENTRANCE & STOREFRONTS
8511 VINYL WINDOWS
8520 ALUMINUM WINDOWS
8710 DOOR HARDWARE
8711 DOOR HARDWARE - POCKET
8800 GLAZING
9250 - GYPSUM BOARD ASSEMBLIES
9300-TILE
9512 - ACOUSTICAL TILE CEILINGS
9678 - RESILIENT WALL BASE AND ACCESSORIES
9706 EPOXY
9900 - PAINTING
10000-BUILDERS SPECIALTIES
12690 FLOOR MATS AND FRAMES
15010 - BASIC MECHANICAL REQUIREMENTS
15050 - BASIC MECHANICAL MATERIALS AND METHODS
15250 - MECHANICAL INSULATION
15300 - FIRE PROTECTION
15400 - PLUMBING
15485 - MEDICAL GAS PIPING SYSTEMS
15880 - AIR DISTRIBUTION
15990 - TESTING, ADJUSTING AND BALANCING
16110 - RACEWAYS
16120 - WIRES AND CABLES
16130 - OUTLET BOXES
16133 - CABINETS
16140 - WIRING DEVICES
16150 - MOTORS
16155 - MOTOR STARTERS
16160 - PANELBOARDS
16170 - MOTOR AND CIRCUIT DISCONNECTS
16181 - FUSES
16410 - ELECTRICAL SERVICE
16450 - GROUNDING
16460 - TRANSFORMERS
16500 - LIGHTING EQUIPMENT
16501 - LAMPS
16502 - BALLASTS AND ACCESSORIES
16511 - FLUORESCENT FIXTURES
16722 - FIRE ALARM SYSTEM
16740 - TELEPHONE SYSTEM

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Drawing Sheets (87 Sheets):

2. (O.F.C.I.) Owner Furnished, Contractor Installed: Equipment to be supplied by the Owner and installed by the Contractor.
3. (C.F.C.I.) New equipment, Contractor Furnished and Installed: Contractor shall provide the equipment as specified and Contractor shall install.
4. (C.F.O.I.): New equipment, Contractor Furnished, Owner Installed Contractor shall provide the equipment as specified, assembled and ready for Owner installation.
5. (N.I.C.) Not In Contract: New equipment, Owner Furnished and Owner Installed. Contractor is to provide rough-ins as specified.

B. New Equipment, Contractor furnished and installed, will not be specifically designated or noted as such. Any equipment not designated specifically, shall be deemed by the Contractor to be new equipment for Contractor furnishing and installation.

C. Equipment to be Owner Furnished and Contractor Installed (O.F.C.I.):

1. Scale (2) – Lobby #128 and garage #158
2. Stainless Steel Treatment Tub Tables, 24”x60” - (2) Treatment #140
3. Ceiling Mounted Surgery Lights - (2) Surgery #141
4. Ceiling Mounted Exam Lights – (2) Treatment #140
5. Dishwashers (4) – RM # 105, 112, 147, 153
6. Run gates: - RM # 117, 120, 138, 155, 158
7. Run gates and partitions – Canine Isolation #156
8. Animal Cages – RM # 104, 106, 113, 116, 131, 137, 139, 143, 148, 157, 158
9. Grooming Tub – Food Prep #153
10. Guillotine Door – RM # 117, 120, 138, 155

SC 5.1.2 All removals and earthwork (BP.1)

A. A. Work under this bid item shall conform to applicable Sections of the (SSPWC), these technical specifications and as shown on the plans. This item includes the following:

- Removal and stockpiling of existing AC grindings from beneath the building footprint, from all areas to be landscaped, from the dog pen area, and from the footprint of the corrals.
- Grading beneath the building footprint as necessary, including excavation of 4 feet and recompaction of existing uncontrolled fill beneath the foundation in accordance with the Geotechnical report and structural design documents. Include with this item a reserve credit amount to remove an addition 2 feet below the 4 feet material and recompact.
- Placement of uncontrolled fill within the dog pen area and corrals to compensate for the previously removed AC grindings. The dog pen will receive 4 inches of DG on the surface. The corrals shall have no rocks larger than 1 inch on the surface.
- Overexcavation in select planter areas as identified on the grading plan, including replacement of imported screened topsoil as specified in the landscape details.
- Subgrade preparation for all site areas as well as for sidewalk embankment along the roadway frontage, including a level area at back of walk and slope transition to existing drainage swale as shown on the civil details.
- Overexcavation of approximately 2,000 square feet of the new parking lot area to make subgrade for the parking lot pavement section.
- Recontouring of the existing slope in the landscape area south of the new parking lot as directed by the owner’s representative.

B. Measurement for this bid item will be per lump sum.

C. Payment for All removals and earthwork shall be made at the unit price named in the bid response, which price shall constitute full compensation for the removal of the existing facilities including mobilization, BMPs, staking, sawcutting, traffic control, excavation, subgrade preparation, fill, screening, grading, compaction, disposal, demobilization, cleanup and all necessary appurtenances and all other labor, tools, equipment, materials, and incidentals required to perform the work. No extra payment will be made for extra street AC removal beyond limits shown on the plans unless approved by the Construction Manager.

C. Payment for Move three sheds shall be made at the unit price named in the bid response, which price shall constitute full compensation for Move three sheds including mobilization, loading, transporting, unloading, traffic control, demobilization, cleanup and all necessary appurtenances and all other labor, tools, equipment, materials, and incidentals required to perform the work.

SC.6 TECHNICAL SPECIFICATION MODIFICATIONS

A. Mechanical/Electrical Requirements of General Work:
   1. Refer to Division-15 and Division-16 sections for characteristics of mechanical and electrical services to be connected to units of general work, and provide units manufactured/fabricated for proper connection and utilization of available services as indicated.
   2. Service Connections: Except as otherwise indicated, final connection of mechanical services to general work is defined as mechanical work, and final connection of electrical services to general work is defined as electrical work.
   3. Electrical Requirements: Except as otherwise indicated, comply with applicable provisions of NEC and standards by NEMA, for electrical components of general work. Provide UL listed and labeled products where applicable.

SC.7 PLAN DETAIL MODIFICATIONS

SC.7.1 Modify PCC Curb & Gutter Type 1 Detail note 2 to "ALL CONCRETE CURB & GUTTER SHALL HAVE ½ INCH FIBEROUS EXPANSION JOINTS EVERY 200 FEET, AT BEGINNING AND ENDS OF CURB, AND AT BOTH ENDS OF DRIVEWAYS. Type A Sidewalks shall match fiberous joint locations on the curb.

SC.7.2 Add Note to S0.5 – EARTHWORK GENERAL NOTES AND DETAILS
Remove 4 feet of existing soil beneath the building foundations, re-use suitable soils and compact to 90% relative density, any clay-like material shall not be re-used.

END OF SPECIAL CONDITIONS