TEXAS
Health and Human Services

Attachment H1

Project Specifications

EL PASO STATE SUPPORTED LIVING CENTER

SITE ELECTRICAL AND WATER DISTRIBUTION REPLACEMENT

Project No.

18-117-ELC

6700 DELTA DRIVE

EL PASO, TEXAS 79905

TEXAS
Health and Human Services

EMC
ENGINEERS

EMC Engineers
2211 E. Missouri Avenue, Suite W-107
El Paso, Texas 79903
Office: (915) 781-2030 • Fax (915) 781-2055
Email: support@emcelpaso.com

BIDDING PACKAGE
January 10, 2019

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Project Directory 1

Project Directory

Texas Health and Human Services Commission
HHSC Maintenance and Construction
P.O. Box 12668 Mail Code 2064
Austin, Texas 78711-2668
(909 W. 45th Street, Bldg. 633, Austin, TX 78751)
Fax (512) 206-5930

Austin:

Director: John Robert	512-206-5888
Assistant Director: Mohammed Ally	512-206-5893
Construction Services Manager: Tony Hackney	512-206-5204
Project Manager: Al Widdifield, Architect Emeritus	325-795-5596

Facility:
El Paso State Supported Living Center
6700 Delta Drive
El Paso, TX 79905
Plant Maintenance Manager: James Lannon 915-782-6455

Consultant(s) to Owner:
EMC Engineers
2211 E. Missouri Ave., Suite W-107
El Paso, TX 79903

Principal: Melvin Glass, P.E.	915-781-2030	ext. 200
Project Engineer: Melvin Glass, P.E. (Mechanical)	915-781-2030	ext. 200
Project Engineer: Robert Blanchette, P.E. (Electrical)	915-781-2030	ext. 207
Construction Administration: Luis Carlos Bustos	915-781-2030	ext. 204

Specifications 2

El Paso SSLC Site Electrical and Water Distribution Replacement
Project Number: 18-117-ELC
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1. PROJECT NUMBER: **18-117- ELC**

TITLE: **Site Electrical and Water Distribution Replacement**

LOCATION: **El Paso SSLC**

2. WORK ORDER DATE:

3. COMPLETION DATE:

4. APPROVED TIME EXTENSION:

5. AMENDED COMPLETION DATE

CONTRACT PROGRESS SCHEDULE

MAINTENANCE & CONSTRUCTION SECTION

TEXAS DEPARTMENT OF MENTAL HEALTH AND MENTAL RETARDATION

P. O. BOX 12668, AUSTIN, TEXAS 78711 512-206-5880

6. SUBMITTED BY: **EMC Engineers**

DATE

7. CONTRACTOR'S NAME, ADDRESS, ZIP, PHONE, SIGNATURE

8. APPROVAL RECOMMENDED BY:

DATE

ARCHITECT/ENGINEER (SIGNATURE)

9. APPROVED BY

DATE

PROJECT MANAGER (SIGNATURE)

ITEM NO	WORK ELEMENTS	%	MONTHS														
		100%															

INSTRUCTIONS TO CONTRACTORS

1. Prepare Contract Progress Schedule in accordance with these instructions and submit to the Project Manager at the time stated in the Contract or as established by the Project Manager.
2. Block 1 – Enter the Project Number, Title, and Location as shown on the Contract.
3. Blocks 2 & 3 – Enter the Work Order Date and Completion Date as specified by the Project Manager in the Work Order letter executing the time period specified in the Contract.
4. Blocks 4 & 5 – Enter the Calendar Days of Time Extensions and amended Completion Date when applicable as specified in Change Orders.
5. Blocks 6 & 7 – Enter the Name and Address of your Firm. The Schedule must be dated and signed by the Contractor or an authorized representative of the Firm.
6. Block 8 – Schedule should be approved by the Commissioned Architect or Engineer supervising the project.
7. Block 9 – Schedule should receive final approval by signature of the Project Manager for final authorized acceptance.
8. Each major work element is to be sequentially numbered and continued on additional pages if needed. Major elements of work, such as excavation, concrete work, carpentry, masonry, paint, mechanical, electrical, Alternate 1, Alternate 2, etc., will be shown in the Work Element Column in logical sequence and in sufficient detail to identify each element.
9. The percentage of each listed work element to the complete job will be shown opposite each element in the % column. For example, if three work elements are shown: excavation, concrete work, and backfill, and it is estimated that excavation is 50% of the total job, concrete 30%, and backfill 20%, these percentages will be shown opposite each element. The total must be 100%. Indicate the percentage graphically by means of a bar graph, within the second horizontal line under months.

SHOP DRAWING LOG / SUBMITTAL SCHEDULE & REGISTER: PROJECT NO. : **18-117-ELC** PROJECT NAME: **El Paso SSLC Site Electrical and Water Distribution Replacement**

SUBMITTAL NUMBER (# by Contractor)	SPEC SECTION & DESCRIPTION	REC'D FROM CONRACTOR	RETURNED TO CONTRACTOR	ACTION		
				APPROVED	APP. AS NOTED	REJECTED
	<u>013000 MOBILIZATION ITEMS:</u> 2.1: Organization Chart, responsibilities / contact info					
	" " 2.2: List of major subs & suppliers (from HSP)					
	" " 2.3: EEO Letters from Prime & subs					
	" " 2.4: Licenses & certifications					
	" " 2.5: Mobilization Plan approved by Facility PPM					
	" " 2.6: Detailed phasing work schedule/sequence of work					
	" " 2.7: Safety Plan " " 2.8: Infection Control Permit					
	<u>APPROVAL REQ'D PRIOR TO 1ST VOUCHER MTG:</u>013000-3.1: Progress Schedule					
	" " 3.2: Detailed Schedule of Values					
	" " 3.3: & UGCs 8.3.1.1: This Submittal Schedule w/ proposed numbers consecutively					
	03 30 00 Concrete Cast In Place – Concrete Testing					
	21 02 016 Fire Protection Piping					
	22 05 00 General Mechanical Requirements					
	22 05 13 Basic Mechanical Materials and Methods					
	22 07 19 Plumbing Insulation					
	*22 11 16 Plumbing Piping – Piping Material and Fittings					
	23 05 53 Mechanical Identification					
	26 05 00 Electrical General Provisions					
	26 05 10 Basic Electrical Materials & Methods					
	26 05 11 Minor Electrical Demolition					
	26 05 19 Building Wire and Cable					
	26 05 26 Grounding and Bonding					
	26 05 29 Supporting Devices					
	26 05 33 Conduit					
	26 05 34 Boxes					
	26 05 53 Electrical Identification					
	*26 13 19 Air Interrupter Switches					
	*26 22 13 Distribution Transformers					
	For Shop Drawing Submittals marked with an * above the Contractor shall provide two (2) hard copies of these submittals. One (1) set are going to Al Widdifield and one (1) set to James Lannon for Owner Review in addition to electronic copies to AE.					

SECTION 01 40 00 - REFERENCE STANDARDS AND CODES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Uniform General Conditions and Supplementary General Conditions, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 SECTION INCLUDES

A. Quality assurance.

B. Schedule of references.

1.3 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or other consensus standards; comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Engineer and Owner before proceeding.

D. The contractual relationship duties and responsibilities of the parties in Contract nor those of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 SCHEDULE OF REFERENCES

AA	Aluminum Association 900 19th St., NW Washington, DC 20006 www.aluminum.org	(202) 862-5100
AABC	Associated Air Balance Council (202) 737-0202 1518 K St., NW Washington, DC 20005 www.aabchq.com	

AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, DC 20001 www.ashto.org	
AATCC	American Association of Textile Chemists and Colorists 1 Davis Dr, Research Triangle Park Durham, N.C. 27709 www.aatcc.org	919-549-8141
ABMA	American Boiler Manufacturers Association 950 N. Glebe Rd., Suite 160 Arlington, VA 22203-1824	
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 www.aci-int.org	
ACI	ACI International P.O. Box 9094 Farmington Hills, MI 48333-9094	
ADA	Americans with Disabilities Act of 2010 (Fed P.L. 101-336)	
ADC	Air Diffusion Council 104 So. Michigan Ave., No. 1500 Chicago, IL 60603	
ADSC	The International Association of Foundation Drilling 9696 Skillman Street, Suite 280 Dallas, TX 75243 www.adsc-iafd.com	(214) 681-5994
AF&PA	American Forest & Paper Association 1111 Nineteenth St. NW, Suite 800 Washington, DC 20036 www.afandpa.org	(202) 463-2700
AGA	American Gas Association P.O. Box 79230. Baltimore, MD 21279-0230	
AGC	Associated General Contractors of America 1957 E Street, N.W. Washington, DC 20006	

AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067 www.hardboard.org	(847) 934-8800
AI	Asphalt Institute Research Park Drive P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org	(606) 288-4960
AIA	American Institute of Architects 1735 New York Avenue, N.W. Washington, DC 20006	
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001www.aisc.org	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW, Suite 1300 Washington, DC 20036 www.steel.org	(202) 452-7100 (800) 277-3850
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112 www.aitc-glulam.org	(303) 792-9559
AMCA	Air Movement and Control Association International, Inc. 30 W. University Dr. Arlington Heights, IL 60004-1893 www.amca.org	(847) 394-0150
ANSI	American National Standards Institute 1819 L. Street, N.W. Washington, DC 20036 www.ansi.org	(202) 293-8020
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	(253) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005-4070 www.api.org	(202) 682-8000
ARI	Air-Conditioning and Refrigeration Institute 4301 North Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org	(703) 524-8800

ARRA	Asphalt Recycling and Reclaiming Association #3 Church Circle, PMB 250 Annapolis, MD 21401 www.arra.org	(410) 267-0023
ASCE	American Society of Civil Engineers World Headquarters 1801 Alexander Graham Bell Dr. Reston, VA 20191-4400 www.asce.org	(703) 295-6300 (800) 548-2723
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329 www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 3 Park Avenue New York, NY 10016-5990 www.asme.org	(800) 843-2763
ASPA	American Sod Producers Association 4415 West Harrison Street Hillside, IL 60162	
ASPE	American Society of Plumbing Engineers 15233 Ventura Blvd., Suite 811 Sherman Oaks, CA 91403	
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(601) 832-9585
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. West Reston, VA 20190 www.awinet.org	(703) 733-0600
AWPA	American Wood-Preservers' Association P.O. Box 5690 Grandbury, TX 76049-7979 www.awpa.com	(817) 326-6300
AWS	American Welding Society 550 LeJeune Road, N.W. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 www.awwa.org	(303) 794-7711

BHMA	Builders' Hardware Manufacturer Association 355 Lexington Avenue, 17th floor New York, NY 10017 www.buildershardware.com	(212) 297-2122
BIA	The Brick Industry Association 11490 Commerce Park Drive Reston, VA 28191-1525 www.bia.org	
BOCA	Building Officials and Code Administrators International, Inc	
CABO	Council of American Building Officials; One & Two Family Dwelling Code and the Model Energy Code	(703) 620-0010
CDA	Copper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10174	
CFR	Code of Federal Regulations North Capitol Street between G & H Streets, NW Washington, DC 20402	
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036	
CPSC	Consumer Product Safety Commission 1111 Eighteenth Street, NW Washington, DC 20207	
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195	
DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22102	
DOT	Department of Transportation 400 Seventh Street, SW Washington, DC 20590	
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005	
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591	
EPA	Environmental Protection Agency 401 M Street, SW Washington, DC 20460	

FCC	Federal Communications Commission 1919 M Street, NW Washington, DC 20554	
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062	
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407	
GA	Gypsum Association 810 First St. NE, Suite 510 Washington, DC 20002	
GANA	Glass Association of North America 2945 SW Wanamaker Drive, Suite A Topeka, KS	(785) 271-0208
HPMA	Hardwood Plywood Manufacturers Association 1825 Michael Faraday Drive P.O. Box 2789	
HPW	H.P. White Laboratory 3114 Scarboro Road Street, MD 21154 Reston, VA 22090-2789	
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601	
ICF ID/RC	Intermediate Care Facilities for Individuals with Intellectual Disability or Related Conditions Texas Administrative Code, Title 40, Part 1, Chapter 90, Subchapter D, General requirements for Facility Construction, applicable to facilities certified by the Department of Aging and Disability Services (DADS) Regulatory Services	
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017	
IES	Illumination Engineering Society of North America 345 East 47th Street New York, NY 10017	

IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005	
IMSA	International Municipal Signal Association165 East Union Street P.O. Box 539 Newark, NY 14513	
ISWA	Insect Screen Weavers Association P.O. Box 1018 Ossining NY 10562	
JCAHO	Joint Commission on Accreditation of Health Care Organizations	
MBMA	Metal Building Manufacturer's Association 1300 Sumner Avenue Cleveland, OH 44115-2851	
MFMA	Maple Flooring Manufacturers Association 60 Rivere Drive, Suite 500 Northbrook, IL 60062 mfma@maplefloor.com	(847) 480-9138
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120	
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601	
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601	
NBS	National Bureau of Standards (U.S. Department of Commerce) Gaithersburg, MD 20234	
NCMA	National Concrete Masonry Association P.O. Box 781 Herndon, VA 22070	
NCRP	National Council on Radiation Protection and Measurement 7910 Woodmont Ave, Suite 800 Bethesda, MD 20814	
NCSBCS	National Conference of States on Building Codes and Standards	
NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180	

NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269 The chart below outlines the commonly referenced applicable National Fire Codes. Other specific National Fire Codes may be applicable.	

Code	Title of NFPA Standard
1	Fire Code
10	Portable Fire Extinguishers
13	Installation of Sprinkler Systems
13D	Installation of Sprinkler Systems in one- and Two-Family Dwellings
13R	Installation of Sprinkler Systems in Residential Occupancies up to and including (4) Four Stories in Height
14	Installation of Standpipe and Hose Sys
17	Dry Chemical Extinguishing Systems
17A	Wet Chemical Extinguishing Systems
25	Inspection, Testing, and Maintenance of
30	Water-Based Fire Protection Systems
54	Flammable and Combustible Liquids Code
58	National Fuel Gas Code Liquefied Petroleum Gas Code
70	National Electrical Code
80	Fire Doors and Other Opening Protectives
90A	Installation of Air Conditioning and Ventilating Systems
90B	Installation of Warm Air Heating and Air Conditioning Systems
91	Exhaust Systems for Air Conveying of Vapors, Gases, Mists and
96	Noncombustible Particulate Solids Ventilation Control and Fire Protection of Commercial Cooking Operations
99	Health Care Facilities
101	Life Safety Code
101A	Guide on Alternative Approaches to Life Safety
105	Smoke Door Assemblies and Other Opening Protectives
110	Emergency and Standby Power Systems
220	Types of Building Construction
241	Safeguarding Construction, Alteration and Demolition Operations

NEC	National Electrical Code (by NFPA)	
NECA	National Electrical Contractors Association 7315 Wisconsin Avenue Bethesda, MD 20814	
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, N.W. Washington, DC 20037	
NFoPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036	
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38135	
NPCA	National Paint and Coating Association 1500 Rhode Island Avenue N.W. Washington, D.C. 20005	
NRCA	National Roofing Contractors Association 8600 Bryn Mawr Avenue Chicago, IL 60631	
NSF	National Sanitation Foundation 3475 Plymouth Road P.O. Box 1468 Ann Arbor, MI 47106	
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Ave., N.W. Washington, DC 20036	
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Avenue Des Plaines, IL 60018	
NWWDA	National Wood Window & Door Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068	
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) Government Printing Office Washington, D.C. 20402 29 CFR 1910	
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077	
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606	

PS	Product Standard U. S. Department of Commerce Washington, DC 20203	
RILEM	International Union of Testing and Research Laboratories for Materials and Structures RILEM Secretariat General ENS-Pavillon des Jardins, 61 avenue du President Wilson F-94235 Cachan Cedex, France	
RIS	Redwood Inspection Service One Lombard Street San Francisco, CA 94111	
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004	
RMA	Rubber Manufacturer's Association 1400 K Street, N.W. Washington, D.C. 20005	
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711	
S.D.I.	Steel Door Institute 712 Lakewood Center North 14600 Detroit Avenue Cleveland, OH 44107	
SGCC	Safety Glazing Certification Council Route 11, Industrial Park Cortland, NY 13045	
SIGMA	Sealed Insulating Glass Manufacturers Association 401 North Michigan Avenue Chicago, IL 60611	(312) 644-6610
SJI	Steel Joist Institute 1205 48th Avenue North, Suite A Myrtle Beach, SC 29577	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180	
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway Pensacola, FL 32504-9094	
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213	

TAS	Texas Accessibility Standards Act of 2012	
TDHS	Texas Department of Human Services: Licensing Standards for Intermediate Care Facilities Serving persons with Mental Retardation or a Related Condition (ICF-MR)	
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540	
UBC UMC UPC	Uniform Building Code Uniform Mechanical Code Uniform Plumbing Code	
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062	
WCLIB	West Coast Lumber Inspection Bureau 6980 S.W. Varns Road Box 23145 Portland, OR 97223	
WRI	Wire Reinforcement Institute 8361 A Greensboro Drive McLean, VA 22102	
WWPA	Western Wood Products Association 1500 Yeon Building Portland, OR 97204	
W.W.P.A.	Woven Wire Products Association 2515 N. Nordica Avenue Chicago, IL 60635	

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 40 00

SECTION 01 50 00 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 STORAGE AREA (I.E. TEMPORARY FIELD OFFICE, STAGING AREAS, TOOL/JOB SHACKS, AND OTHER CONSTRUCTION FACILITIES):

A. There are no State furnished covered or secure storage areas. Limited on campus, off-site storage may be permitted at the discretion of the Facility and on a space available basis. The plans show the general location of the Contractor storage area for this project. Utilities at the storage area may or may not be available for Contractor use. The Owner implies no responsibility for lost or stolen materials, equipment or tools, the security of which lies solely with the Contractor. Contractor shall keep his storage areas clean, neat and orderly and shall keep grass mowed to a maximum height of 4 inches. Temporary fencing used by the Contractor to delineate construction sites shall be securely anchored with tension wires and posts as required to prevent sagging and an unsightly appearance. Fencing shall be maintained by the Contractor in this manner throughout the life of the contract. Due to high winds in west Texas, Contractor shall take every precaution to preclude trash from blowing off site.

B. Contractor shall post at the job site on a bulletin board or other suitable surface the provided Rules & Regulations, as well as wage rates, job site Points of Contact, and other relevant project information.

1.2 TOILET FACILITIES:

A. There are no toilet facilities available for Contractor use. Contractor shall provide his own portable/temporary toilet facilities at specified storage area.

1.3 IDENTIFICATION OF CONTRACTOR VEHICLES:

A. Contractor vehicles shall be marked on each side with company name with either permanent or semi-permanent/magnetic signage to aide in identifying them.

1.4 STREET CLOSINGS:

A. When road closures are required notification must be made to the Facility a minimum of seven (7) days in advance. One lane of traffic shall be maintained at all times unless otherwise approved by the Facility.

B. The final street repair shall be completed within fourteen (14) days after the start of any street demolition for utility crossings or other purposes. Any part of the street returned to service prior to final repair shall be maintained smooth with compacted aggregate base course or cold-lay surface course.

1.5 CLEAN-UP:

A. The Contractor shall at all times keep the construction site and storage area(s) free from accumulation of waste, rubbish, weeds, overgrown grass or construction debris. All loose or light-weight materials shall be secured to prevent blowing or scattering. The burning of trash or construction debris is strictly prohibited. Prior to final inspection, the Contractor shall remove all construction debris, tools, equipment, and materials not the property of the State. Upon completion of the work, the Contractor shall leave the work site and storage area(s) in a clean, neat and workmanlike condition satisfactory to the Facility.

1.6 SECURITY AND CLIENT PROTECTION REQUIREMENTS:

A. Access to El Paso State Supported Living Center is controlled. This Living center serves a unique and challenging clientele. Security requirements can be briefed at the pre-construction conference. Requirements are subject to change. Full cooperation by Contractor work forces is required. Contractor should anticipate certain notification and reporting requirements, preparation of forms and lists for pass and identification (badges) of employees and their vehicles, entry restrictions, key/lock control, and compliance with all Facility traffic rules and regulations.

1.7 FACILITY SPECIFIC WORKING CONDITIONS: Reference UGC/SGC Article 7.

A. **DEBRIS, CONSTUCTION, WASTE, ETC.** – Contractor must pick up all construction debris and waste materials daily. In addition to being unsightly, left behind or dropped items can be a serious health hazard to our residents. Some of our residents' exhibit a behavior known as PICA. PICA refers to an individual who puts non-food materials into their mouths to eat. This could be a variety of items, such as; screws, pieces of metal, plastic bags, shards of glass and even candy/food wrappers.

E. **SYSTEM OUTAGES** – coordinate with the Maintenance Department, in advance, any utility or service outages you may need. The Maintenance Department will take care of notifying affected areas. The maintenance technicians can also be a big help to you in locating buried utilities, getting access to rooms and buildings.

F. **SIGN IN** – as a guest on the campus, each contractor's crew is asked to sign in at the Plant Manager's Office when arriving for work for the day. This will help the Maintenance Department answer questions from others on the campus who may inquire about "strangers" in or outside their buildings.

G. **SAFETY AT ALL TIMES** – contractors must perform their work safely and maintain especially high safety standards to avoid creating hazards to the residents and staff of the campus. Contractors must anticipate that, due to

the nature of the residents, there may be unusual behaviors and medical susceptibilities to be considered. Contractor personnel should discuss their work with the Maintenance Department to avoid unnecessary risk to people on campus and operations.

END OF SECTION 01 50 00

SECTION 01 70 00 – CLOSEOUT

PART 1 - AS-BUILT DRAWINGS AND REAL PROPERTY DOCUMENTATION:

1.1. AS BUILTS:

A. The Contractor shall maintain one set of the project drawings with red-lined "as-built" condition notations and markings. The Contractor shall mark these plans to indicate all "as-built" construction, changes, addenda, and utilities encountered and shall maintain them on the job site and available for viewing by the A/E, ODR, and/or the Facility at any time. These as-builts shall be readily available for review at each pay voucher meeting. Submit them to the A/E prior to substantial completion inspection for validation. Updated notations and markings shall be neat, clear, legible and accurate in all respects.

1.2. OPERATION & MAINTENANCE (O&M) AND INSTRUCTION MANUALS:

A. WARRANTIES/GUARANTEES: Refer to UGC/SGC Article 13.

1. Any warranties given to the Contractor or subcontractor at any tier from a manufacturer of equipment or other items, which are provided under this contract, shall be transferred to the Facility upon final acceptance in accordance with the clauses contained in the basic contract Uniform and Standard General Conditions. Contractor shall submit in writing a single listing with all applicable warranties, dates in effect, and all other pertinent information attached. This listing and the warranties shall be the first tab in the O&M Manuals described above.

1.3. CERTIFICATION OF NO ACM: Refer to UGC/SGC Article 13.7.

A. The Contractor must provide a <u>notarized</u> certificate attesting to the fact that no (ACM) Asbestos Containing Materials were incorporated into the work. This certificate shall be included as the second tab in the O&M Manuals described above.

1.4. FINAL PAY VOUCHER:

A. Refer to UGC/SGC Article 12. In particular be sure to provide Consent of Surety to Final Payment <u>and</u> Power of Attorney. Also, the affidavit of all bills paid is different from the monthly affidavit used for the previous pay vouchers.

END OF SECTION 01 70 00

SECTION 03 30 00 – CONCRETE CAST IN PLACE

PART 1 – GENERAL

1.1. REFERENCE STANDARDS

A. American Concrete Institute (ACI):

1. Recommended Practice of Evaluation of Compression Test Results of Field Concrete (ACI 214).
2. Specifications for Structural Concrete for Buildings (ACI 301).
3. Building Code Requirements for Reinforced Concrete (ACI 318).
4. Recommended Practice for Selecting Proportions for Concrete (ACI 613).
5. Selection and Use of Aggregate for Concrete (ACI Comm. 621)
6. ACI Manual of Concrete Inspection (SP-2).
7. Recommended Practice for Measuring, Mixing and placing concrete (ACI 614).

B. American Society for Testing Materials (ASTM):

1. Standard Method for Making and Curing Concrete Compression and Flexure Test Specimens in the Field (ASTM C 31).
2. Standard Specifications for Concrete Aggregates (ASTM C 33).
3. Standard Method of Test for Compressive Strength of Molded Concrete Cylinder(ASTM C 39).
4. Standard Method of Obtaining and Testing drilled Cores and Sawed Beams of Concreted (ASTM C 42).
5. Standard Specification for Ready-Mixed Concrete (ASTM C 94).
6. Standard Method of Test for Sieve of Screen Analysis of Fine and Coarse Aggregate (ASTM C 136).
7. Standard Method of Test for Slump of Portland Cement Concrete (ASTM C 143).
8. Standard Specification for Portland Cement (ASTM C 150).
9. Standard Method of Sampling Fresh Concrete (ASTM C 172).
10. Standard Specification for Air-Entraining Admixtures for Concrete (ASTM C 260).
11. Standard Specification for Chemical Admixtures for Concrete (ASTM C 494).

C. Portland Cement Association: Design and Control of Concrete Mixtures.

D. Latest Edition of each of above Governing Standards shall apply. Except as modified in this Section or the other related Sections, ACI 301 shall generally apply to all concrete work in this project.

1.2. SUBMITTALS

A. The proposed concrete mix design for each separate class of concrete shall be submitted by the Contractor for review by the Director of Engineering or his/her designated representative.

B. Design Mix Proportions together with certifications by an independent testing laboratory or by the material manufacturer that proposed grout setting bed for base and bearing plates will reach the specified strength shall be submitted for review by the Director of Engineering or his/her designated representative.

1.3. COORDINATION OF WORK

A. If concrete is supplied by a ready-mix concrete producer, the Contractor shall coordinate the delivery of all off-site produced concrete.

PART 2 – PRODUCTS

2.1. PORTLAND CEMENT

A. Portland cement shall conform to the requirements for Type I or III cement of ASTM C 150.

2.2. AGGREGATES

A. Fine aggregate shall consist of natural and/or manufactured sand having hard, strong and durable particles and which conform to the requirements of ASTM C 33.

B. Coarse aggregate shall consist of clean, hard fine-grained, sound crushed rock or washed gravel which do not contain in excess of five (5) percent by weight of flat, chip-like, thin, elongated, friable or laminated pieces, or more than on (1) percent by weight of shale or cherty material. Any piece having a major dimension in excess of two and one-half (2 ½) times the average thickness shall be considered to be flat or elongated. Coarse aggregate shall conform to the requirements of ASTM C 3.

C. Refer to concrete quality table for maximum sizes of aggregate permitted for each class of concrete.

2.3. WATER

A. Water shall be clean water from the utility company mains, free from acids, alkalis, oils or organic materials and shall be suitable for dinking purposes.

2.4. ADMIXTURES

A. Air-entraining admixtures shall conform to ASTM C 260.
B. All other admixtures shall conform to ASTM C 494.

1. Type A: Water Reducing
2. Type B: Retarding
3. Type C: Accelerating
4. Type D: Water-Reducing and Retarding
5. Type E: Water Reducing and Accelerating
6. Type F: High-Range, Water-Reducing
7. Type G: High-Range, Water Reducing and Retarding

C. Approval of any admixtures is required before use in concrete.

D. No calcium chloride shall be used as an admixture under any circumstances in any concrete in this project.

2.5. EMBEDDED ITEMS

A. All embedded steel plates, shapes, etc. shall conform to the requirements of ASTM A 36 and shall be galvanized. Coat with “Galvanized” where galvanizing is damaged, at bends, and at welds etc.

B. Reinforcing steel bars:

1. Reinforcing steel bars for all concrete construction shall be deformed bars conforming to ASTM A 615, Grade 60, unless noted otherwise on the drawings.

2.6. QUALITY OF CONCRETE

A. The exact proportions of cement, aggregate and water for each class of concrete shall be determined by an approved independent testing laboratory. Mix design shall be based on the saturated surface dry (SSD) condition of the aggregate. The contractor shall pay for all mix designs.

B. Review by the Director of Engineering or his/her designated representative of mix design submitted does not relieve the contractor of the sole responsibility for each mix design to produce concrete of the strength specified.

C. The required minimum strength of concrete cores at 28 days, minimum laboratory strength in 28 days, minimum number of sacks of cement per cubic yard of concrete, maximum size of aggregated and required slump of the concrete as delivered at the job site for each of the indicated classes of

concrete construction shall be as shown in the Concrete Quality table that follows:

2.7. CONCRETE QUALITY

Class of Concrete Constr.	Minimum Core Test @28 Days	Minimum Lab Test @28 Days	Min.No. Sack of Cement	Maximum Aggregate (inches)	Req'd Slump Type	Admix-ture (p.s.i)	Cement Type (p.s.i)
Machine	3000	3600	6	¾	3 ½	E	I

A. Slumps shown in the above Concrete Quality table are at place of final deposit of concrete Slumps tolerance shall be plus a minimum one (1) inch for 3 ½ inch or greater and plus a minimum ½" for 3" slump or less.

PART 3 – EXECUTION

3.1. STORAGE OF MATERIALS

A. Protect all materials from damage or contamination by water, dirt, or other substances while stored at either the project site or the production site and during delivery.

B. Store all materials above and clear of the ground surface except for aggregate.

C. The method of delivering the aggregates to the work and storing and handling shall be such that the moisture content of the aggregates as they come to the mixer shall not be subjected to frequent or unnecessary changes. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates.

3.2. MIXING OF CONCRETE

A. Measuring and mixing of concrete shall be in accordance with the recommended practices of ACI 614 and PCA.

B. All concrete shall be thoroughly mixed in approved batch-mixer conforming to the requirements of the Mixer Manufacturer Bureau of the Associated General Contractor of America.

C. All concrete materials shall be batched by weight. Materials for concrete shall be measured within the following percentages of accuracy:

Cement	1%	Water	1%
Aggregates	2%	Admixtures	3%

D. Fine and coarse aggregates shall be separately measured, and the water required by the concrete mix designs shall include the water that is contained in the aggregates. The method used for measuring shall be subject to the approval of the Director of Engineering or his/her designated representative and shall be such that all mix ingredients can be uniformly accurately controlled and easily checked. Fine and coarse aggregates shall be measured loose and moist as delivered on the job.

E. Each batch of 2 cubic yards or less shall be mixed for not less than 1 ½ minutes after all ingredients are in the mixer. Mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof. Each batch shall be completely discharged before another is mixed.

3.3. TRUCK-MIXED CONCRETE:

A. The use of truck-mixed concrete will be permitted if consistent with the general provisions of this Section and ASTM C 94.

B. The mixing time length and the number of revolutions of mixing shall conform to ASTM C 94. Concrete shall be rejected if not placed within 1 ½ hours after water is first added or if 300 revolutions have taken place, whichever comes first.

C. No water shall be added to any truck-mixed concrete after leaving the batching plant.

3.4. DELIVERY TICKETS

A. Duplicate delivery tickets, one for the Contractor and one for the Director of Engineering or his/her designated representative shall be furnished with each load of truck-mixed concrete delivered to the project site.

B. Delivery tickets shall provide the following information:

1. Ticket number
2. Date
3. Name of ready-mixed concrete producer
4. Name or number of plant at which concrete is batched
5. Truck number
6. Contractor's name
7. Job name and location
8. Type of cement used (i.e. I, III, air-entrained, etc.)
9. Class of concrete together with required strength, cement content, maximum size of aggregate and slump
10. Time dispatched from plant, time arrived at job site, time left job site
11. Type, name and amount of admixture, if any

12. Amount of concrete in load in cubic yards
13. Amount of water added at job, if any, with signature of person authorizing the added water

3.5. USE OF ADMIXTURES

A. Admixtures for the purposes of increasing workability or appearance of the concrete, or for improving any other characteristic, will be permitted, but only with the approval of the Director of Engineering or his/her designated representative. Any proposed admixture shall conform to the requirements of ASTM C260- or C 494.

B. Admixture shall be added by methods and in quantities recommended by the manufacturer. The Contractor shall be responsible for incorrect usage of type or quantity or admixtures.

3.6. CONCRETE TESTING PROCEDURES:

A. The Contractor shall furnish all materials that are to be tested at no cost to the Owner. All testing will be conducted in accordance with the herein before listed ASTM Standards and Specifications by an established independent testing laboratory selected and paid by the Owner.

B. The Contractor shall be responsible for notifying the laboratory at least 12 hours before it is necessary to make test cylinders. If the Contractor places concrete without notifying the laboratory, the Director of Engineering or his/her designated representative will have the concrete tested by means of a core test as specified in ASTM C 42 at the Contractor's expense.

C. Sampling of fresh concrete shall be in accordance with ASTM C 172.

D. Slump tests shall be made every time test cylinders are made in accordance with ASTM C 143 and reported by the testing laboratory. Additional slump tests may be required if any batches or deliveries are in doubt as to quality and as required for good control. The Contractor shall have slump measuring equipment available at the site at all times. Any slump test made by the Contractor shall be made in the presence of the Director of Engineering or his/her designated representative.

E. Test Cylinders will be made of concrete that is actually being placed at the project site and in accordance with ASTM C 31. Normally, one test shall consist of three cylinders: one for testing at end of 7 days and two (2) for testing at the end of 28 days. One test shall be made for each 50 cubic yards or fraction thereof in each day's placing and for each separate specified class of concrete.

F. The Contractor shall provide adequate facilities as required by the testing laboratory for safe storage and proper curing of concrete test cylinders on the project site for the first 24 hours as required by ASTM C 31.

G. If the Contractor desires to remove shoring earlier than at 14 days, at least two additional cylinders for the purpose of determining the compressive strength of the concrete slab at the time of removal of the forms shall be made. Such test cylinders shall be properly identified, protected in the same manner that the corresponding concrete is being protected and left at the job site until required for testing. The Contractor shall pay for all of these additional tests.

H. Testing of cylinders will be in accordance with ASTM C 39.

3.7. EVALUATION OF CONCRETE TEST

A. The concrete cylinder tests shall be evaluated in the following manner.

B. The concrete shall be considered acceptable if:

1. The average of the two 28 days compression tests is equal to or greater than the required laboratory minimum 28 days strength specified for each particular class of concrete construction.
2. But, if any one of the two 28 day compression test is less than the average of these two tests by more than 10%, that entire test shall be considered erratic and no indicative of the concrete strength. Core samples will be required of this concrete.

C. Should any of the 28 day compression tests show an average compressive strength less than required laboratory minimum 28 day strength specified for each class of concrete construction, the cement content of the remaining concrete to be placed shall be increased as will be regulated by the Director of Engineering of his/her designated representative to insure concrete at adequate strength throughout the remainder of the work and no charge shall be made to the Owner for this increased cement content.

D. If any 28 day compression tests indicate that concrete of low strength has been placed which cannot safely, in the opinion of the Director of Engineering or his/her designated representative, sustain the loads for which it has been designed under laws and regulations, the concrete in question shall be tested by taking cores from such portions of the work as the Director of Engineering or his/her designated representative may direct. At least three representative cores shall be taken and tested as specified in ASTM C 42.

E. If compression tests of the core specimens show that the concrete is inadequate for design loads and stresses, the concrete shall be strengthened, defective members of materials replaced, or load tests of the area required as

will be regulated by the Director of Engineering or his/her designated representative.

F. The taking and testing of core samples, the replacement of strengthening of defective concrete and area load test shall be entirely at the expense of the Contractor.

3.8. TESTING OF CONCRETE

A. The Contractor will provide all materials that are to be tested. The Contractor shall notify the testing laboratory 24 hours prior to the placement of any concrete. The testing laboratory will submit three (3) copies of each report to the Director of Engineering or his/her designated representative and two (2) copies of the report to the Contractor. See General Requirements.

B. Concrete for each test shall be tested at the place of deposit for slump and entrained air and these values recorded on the test report.

C. The Contractor shall keep a standard slump cone and bull nosed rod on the job site for any additional slump tests required by the Director of Engineering or his/her designated representative where a variation of slumps is visible.

3.9. MEASUREMENT AND PAYMENT

A. The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be considered subsidiary to pertinent items.

END OF SECTION 03 30 00

SECTION 21 05 16 - FIRE PROTECTION PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

B. The Contractor shall modify existing fire main entrance to connect to existing sprinkler system riser in accordance with local code requirements and NFPA 13. The drawings show the minimum requirements Contractor to provide and install any additional materials and equipment to meet local code requirements.

1.03 RELATED SECTIONS

A. Section 31 23 16 – Trenching.

B. Section 23 05 53 – Mechanical Identification.

1.04 REFERENCES

A. ANSI/ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

B. ANSI/ASME B16.5 – Pipe Flanges and Flanged Fittings.

C. ANSI/ASTM A47 – Malleable Iron Castings.

D. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

E. ASTM A120 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.

F. AWWA – C900.

G. NFPA 13 – Installation of Sprinkler Systems.

H. NFPA 24 – Installation of Private Fire Service Mains and Their Appurtenances

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00 and 22 05 00.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floors and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

D. Manufacturer's Field Report: Submit under provisions of Section 22 05 00.

E. Manufacturer's Field Report: Indicate time of start-up of treatment systems and include analysis of system water after cleaning and treatment.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 22 05 00.

B. Maintenance Instructions: Include installation instructions, spare parts lists, procedures, and treatment programs.

1.07 QUALITY ASSURANCE

A. Sprinkler Systems: Perform work to NFPA 13.

B. Welding Materials and Procedures: Perform to ASME Code.

C. Valves: Bear UL or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Maintain one copy of each document on site.

1.08 EXISTING UTILITIES

A. The drawings indicate the locations, type and sizes of various utilities within the site where known. These utilities are indicated as accurately as possible. If the Contractor encounters any utilities or differing conditions during construction, which are not shown on the drawings, they shall request in writing for written instructions from the Engineer. Any relocation or remodeling required will then

be directed by a change order. This Contractor shall assume all responsibility for protection of all utilities, shown or not, and for repair required by this construction.

B. Contractor shall verify location, size, elevation, pressure and any other pertinent data of the existing utilities. The Contractor shall provide a written report with drawings indicating this existing utilities information, such as utility locations and water flow information. Additional costs incurred due to failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by the Contractor.

C. All costs associated with providing utilities including, but not limited to, connection fees, meters, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by the utility company.

D. Submission of a bid by the Contractor shall be considered an acknowledgment by the contractor of his compliance with this section.

E. The Contractor shall coordinate with Owner and this Engineer's office any work that has the potential to hinder mechanical and plumbing services to areas outside this contract. All shut downs or tie-ins relating to these systems shall be scheduled and submitted in writing to be approved by the Owner, Architect, and this Engineer's office. Contractor shall submit in writing a schedule of construction phasing that indicates areas of first priority during each phase and anticipated completion times. Schedules shall be submitted a minimum of 7 days prior to commencing work. Owner and this Engineer's office shall review these schedules and notify the contractor of acceptance prior to commencement of work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 22 05 00.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.10 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Texas and City of El Paso Fire code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

D. At the end of warranty period the Contractor shall perform a Backflow Inspection per the requirements of the El Paso Plumbing Codes and shall turn a copy over to the Owner and a copy to El Paso Water Utility per their requirements.

PART 2 – PRODUCTS

2.01 SPRINKLER PIPING, BURIED

A. PVC Pipe: AWWA C900, DR-14.

1. Fittings: ASTM D2466, PVC.
2. Joints: ASTM 3139 with gaskets to ASTM F 477.

2.02 SPRINKLER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53; ASTM A120; ASTM A795; ANSI/ASTM A135; ASTM A795; ANSI/ASME B36.10; Schedule 10 40 black.

1. Steel Fittings: ANSI/ASME B16.9, wrought steel, butt welded; ANSI/ASME B16.25, butt weld ends; ASTM A234, wrought carbon steel and alloy steel; ANSI/ASME B16.5, steel flanges and fittings; ANSI/ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ANSI/ASME B16.1, flanges and fittings; ANSI/ASME B16.4, screwed fittings.
3. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type. ANSI/ASTM A47.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.03 GATE VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.

3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to and including 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.

C. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, double wedge, flanged or grooved ends.

2.04 GLOBE OR ANGLE VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, screwed ends, with back seating capacity repackable under pressure.

C. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.05 BALL VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to and including 2 Inches: Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends with

union.

C. Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged or grooved.

2.06 BUTTERFLY VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

C. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, wafer or lug ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

2.07 CHECK VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to and including 2 Inches: Bronze swing disc, screwed ends.

C. Over 2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

D. Over 4 inch: Iron body; bronze trim, stainless steel spring, renewable composition

disc, screwed, wafer or flanged ends.

2.08 DRAIN VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Stockham.
4. Red-White.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Bronze compression stop with hose thread nipple and cap.

C. Brass ball valve with cap and chain, 3/4 inch hose thread.

2.09 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventer

1. Manufacturers:
   a. Wilkins/Zurn Model 375DA.
   b. Watts Model 909.
   c. Febco Model 825.
   d. Beeco Model 12.
   e. Danfoss Model RPZ
   f. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.
2. Under 2 Inches: ANSI/ASSE 1013, and AWWA C506; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two OS&Y gate valves, strainer, and four test cocks. Provide 3/4” parallel reduced pressure backflow preventer with same accessories and a City of El Paso Water Utility approved water meter (calibrated in gallons).
3. Over 2 Inches: ANSI/ASSE 1013, and AWWA C506, Cast iron body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate OS&Y valves, strainer, and four test cocks.

Provide 3/4 inch parallel reduced pressure backflow preventer with same accessories and a City of El Paso Water Utility approved water meter (calibrated in gallons).

B. Backflow Preventer Exterior Enclosure:

1. Manufacturers:
   a. Hot Box.
   b. Hydrocowl.
   c. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.
2. If backflow preventer is installed outside the unit shall be enclosed in an insulated enclosure. The enclosure shall be certified as meeting the requirements of ASSE 1060 “Performance Requirements for Outdoor Enclosures”.
3. Enclosure roof, wall and panels shall be constructed of aluminum with aluminum or fiberglass structural members. Multi-section enclosure shall use tongue and groove joints. Enclosure shall be securely attached to a concrete base with adjustable interior stainless steel anchors.
4. Unit shall be insulated with polyisocyanurate foam laminated to the panels. The walls shall be a minimum 1-1/2” thick and roof shall be a minimum 3” thick.
5. Access panels shall be removable to allow access for operation, maintenance and test of backflow preventer.
6. Access panels shall be secured with padlock hasp and staples.
7. Unit shall be equipped with heating to maintain +40°F with exterior outside temperature of -30°F and a wind velocity of 15 mph. Electrical power source and accessories shall be GFCI protected, with 18” clearance from receptacle base to grade.
8. Mounting hardware shall be furnished and be stainless steel.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.03 INSTALLATION

A. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 24 for service mains.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, and not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

G. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding

H. Do not penetrate building structural members unless indicated.

I. Provide sleeves when penetrating footings floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

J. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

L. Provide gate, ball or butterfly valves for shut-off or isolating service.

M. Provide drain valves at main shut-off valves, low points of piping and apparatus.

N. If the backflow preventer is installed outside, it shall be assembled and mounted in an enclosure on a concrete pad according to the manufacturer's recommendations and as indicated on the drawings.

1. Enclosure shall be install plumb, level and square.

2. Concrete pad shall be 4" thick and 6" larger than enclosure in all directions.

3. Provide letter of approval of installation from Water Utility.

4. At the end of warranty period the Contractor shall perform a Backflow Inspection per the requirements of the El Paso Plumbing Codes and shall turn a copy over to the Owner and a copy to El Paso Water Utility per their requirements.

3.04 TESTS:

A. Tests shall be complete prior to final inspection and prior to covering with insulation or earth.

B. All pressure tests shall be charted using a stripe chart recorder with enough paper for the duration of the test shown. Refer to other specifications for additional requirements. The test results shall include test run, test date, person doing the testing, and Engineer or authority having jurisdiction signature.

C. Hydraulically test fire protection at 200 psig. Test to be held for a minimum of six (6) hours.

D. Refer to Section 22 05 00 – General Mechanical Requirements for additional information.

END OF SECTION 21 05 16

SECTION 22 05 00 – GENERAL MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 – General Requirements apply to work of this section.

1.2. DESCRIPTION

A. Work covered by this Division shall consist of furnishing all labor, equipment, supplies and materials and in performing all operations necessary for the installation of complete and operating mechanical systems as required by these specifications and/or shown on the drawings, subject to the terms and conditions of the contract. The work shall also include the completion of such mechanical and electrical details not mentioned or shown which are necessary for the successful operation of all systems described on the drawings or required by these specifications; this includes the furnishing all materials for the filling the systems to make them operable, including water, refrigerant, oil and grease. Prove satisfactory operation of all equipment and controls to the Engineer on request.

B. Work not included – Certain labor, material and equipment may be furnished and/or installed under other divisions of these specifications. This Contractor shall coordinate with other trades and arrange his work to make the parts fit together. The following items are to be accomplished under other divisions of these specifications:

1. Temporary Heat: Refer to paragraph in this Section.
2. Temporary Water and Toilet: Refer to General Conditions.
3. Electrical Equipment and Wiring: Refer to paragraph in this Section.
4. Concrete: Refer to paragraph in this Section.

C. Equipment Furnished by Owner – Rough-in services pipes to locations as required by mechanical drawings and equipment shop drawings. Provide service valves on all pipes except waste and vent pipes. Plug and cap all waste and vent pipes. Final Connection to equipment will be made by this Contractor.

1.3. BIDDING

A. All mechanical equipment shall be new unless specified otherwise in the specifications or on the drawings.

B. All bids must be based only on the equipment and materials as scheduled on the drawings and as specified or on equivalent equipment and materials from a preapproved alternative manufacturer. No bid may be based on a substituted or other alternative without specific written prior approval from the Engineer. Any Contractor who assumes equivalence of products and who bases his bid on that assumption does so at his own risk.

C. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternative to the scheduled items; it merely means that for bidding prior approval is not required. All fixtures and devices must still be submitted according to the prescribed procedures. In addition, some items that have an important visual affect, e.g. electric water coolers, may be required to receive Owner's approval also.

1.4. EXISTING UTILITIES

A. The drawings indicate the locations, type and sizes of various utilities within the site where known. These utilities are indicated as accurately as possible. If the Contractor encounters any utilities or differing conditions during construction, which are not shown on the drawings, they shall request in writing for written instructions from the Engineer. Any relocation or remodeling required will then be directed by a change order. This Contractor shall assume all responsibility for protection of all utilities, shown or not, and for repair required by this construction.

B. Contractor shall verify location, size, elevation, pressure and any other pertinent data of the existing utilities. The Contractor shall provide a written report with drawings indicating this existing utilities information, such as utility locations and sewer invert information. Additional costs incurred due to failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by the Contractor.

C. All costs associated with providing utilities including, but not limited to, connection fees, meters, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by the utility company.

D. Submission of a bid by the Contractor shall be considered an acknowledgment by the contractor of his compliance with this section.

E. The Contractor shall coordinate with Owner and this Engineer's office any work that has the potential to hinder mechanical and plumbing services to areas outside this contract. All shut downs or tie-ins relating to these systems shall be scheduled and submitted in writing to be approved by the

Owner, and this Engineer's office. Contractor shall submit in writing a schedule of construction phasing that indicates areas of first priority during each phase and anticipated completion times. Schedules shall be submitted a minimum of 7 days prior to commencing work. Owner, and this Engineer's office shall review these schedules and notify the contractor of acceptance prior to commencement of work.

1.5. CODES, PERMITS AND FEES

A. Contractor shall comply with all local, state and national codes and shall pay for all applicable costs, meter costs, fees, permits, licenses and inspections for this division

B. The mechanical work shall be performed in strict accordance with the applicable and Adopted provisions of the International Building Code International Plumbing Code, International Mechanical Code and International Energy Conservations Code as adopted and interpreted by the State of Texas, City of El Paso and the National Fire Protection Association (NFPA) regulations, current adopted edition regarding mechanical systems, fire systems and electrical systems. All materials and labor necessary to comply with Rules, regulations and ordinances shall be provided. Where the drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or specifications shall govern. The contractor shall hold and save the Owner and Engineers free and harmless from liability of any nature or kind Arising from his failure to comply with all applicable codes and ordinances.

1.6. TEMPORARY HEAT

A. Temporary heat will be furnished by the Contractor. Use of the permanent heating system will not be allowed without written authorization from the Engineer and Owner. In case the permanent heating system is used for temporary heat, the Contractor shall pay all the costs until acceptance by the Owner. Warranty of equipment shall not start until acceptance by the Owner.

1.7. DRAWINGS

A. Contract drawings are diagrammatic only and are not intended to be scaled for dimensions. All dimensions shall be taken from certified equipment drawings and from the structure itself before fabricating and work. All space requirements shall be verified, coordinated with other trades, as it is the various Contractors' responsibility to install the systems complete in the space provided without extra charges to the Owner.

B. It is intended that anything, including labor and materials, which is usually furnished as part of any equipment specified and which is necessary for operation shall be furnished as part of the Contract without additional cost, whether or not shown or described.

C. All piping in finished areas of the building shall be concealed except where otherwise noted on the drawings.

D. All equipment shall be installed in accordance with manufacturer's recommendations, unless approval is given in writing be the Consulting Mechanical Engineer for deviation prior to commencement of work.

1.8. REQUIREMENTS OF REGULATORY AGENCIES

A. The mechanical work shall be performed in strict accordance with the local and state codes, ordinances, and regulations governing the particular work involved. Furnish, without extra charge, any additional material and labor when and where required to comply with these Rules and Regulations, though the work is not mentioned in the Specifications or shown on the Drawings. When the Specifications or Drawings call for or describe materials or construction of a better quality or larger sizes than required by the above mentioned Rules and Regulations, the provisions of these Specifications and accompanying Drawings shall take precedence.

1.9. QUALIFICATIONS

A. All mechanics shall be capable journeymen, apprentices or helpers, skilled in the work assigned to them with licensing required by the inspecting authority. All welders must have been certified within the past three years to perform the work, which they are doing.

1.10. WARRANTY

A. All materials and equipment shall be new unless otherwise specified.

B. Guarantee all workmanship, material and equipment and replace any found defective without cost to the Owner, for ONE year after final acceptance, as defined in General Conditions.

C. Each warranty for longer than one year as described above (that comes with equipment used on the job) shall be passed into the Owner in the Operation and Maintenance Manual, along with the dates of start and end of warranty.

D. Refer to General Conditions for additional information regarding specific warranty requirements.

1.11. PROJECT RECORD DOCUMENTS

A. Before final payment, provide the Engineer with one clean set of drawings and specifications corrected up-to-date as job progress. These documents shall reflect the As-Built conditions. Refer to General Conditions for additional information.

1.12. SUBMITTALS

A. The intent of this section is to give general submittal information, refer to specific submittal information in the subsequent mechanical sections.

B. Within 10 days after award of the contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Minimum of six (6) copies, or as directed by the Engineer, of each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the specifications or in schedules on the drawings.

C. Requirements for each submittal:

1. Bear a dated stamp or specific written indication that the Contractor and General Contractor have reviewed and approved all submittal prior to submission to Engineer,
2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Engineer shall not extend to these areas unless specifically noted by Engineer),
3. **BE CLEARLY AND SPECIFICALLY** marked as to which specific piece of equipment is being submitted, bye use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
4. **BE CLEARLY AND SPECIFICALLY** marked as to which available options are being submitted that are associated with a piece of equipment, and
5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable the Engineer to review the proposed equipment.
6. **BE CLEARLY AND SPECIFICALLY** marked as to any and all submittal deviations from the design specification requirements shall be provided in written form.
7. Omission by Contractor of any of the above requirements or submittals will subject submittal to automatic rejection without review.

8. Any submittals received by Engineer that were not requested shall be returned without review of any kind.
9. Submittals shall indicate minimum access and service clearances if required by the submitted equipment.

D. Installation Instructions – For certain products or systems as identified in subsequent specifications sections or on the drawings, the Contractor shall be required to provide copies of manufacturer's installation instructions with the submittal. When required as such, the installation instructions are considered part of the submittal and their omission may result in automatic rejection of the submittal. Where more than one identical device are scheduled, only one set of installation instructions needs to be submitted, e.g. if seven five-ton split systems air conditions are scheduled, only one five-ton unit installation instruction needs to be submitted. Similarly, if one set of installation instructions is identified by the manufacturer and on the instructions to be applicable to more than one type or size of devices, e.g. if one set of air conditioner instructions is good for three, four, five-ton units, then only one instruction set is required for these devices.

E. This Engineer will review the submittals for approval twice. Any additional reviews that are required by the engineer for whatever reason after the initial two reviews will result in additional compensation for the Engineer's time by the submitting Contractor at the Engineer's rate.

1.13. PRIOR APPROVAL OF SUBSTITUTED PRODUCTS

A. Material or equipment specified by Manufacturer's name and model number is being used as a basis of standard and performance. No substitution is allowable without Engineer's written approval **FOURTEEN (14) DAYS PRIOR TO BID DUE DATE** unless the manufacturer is listed on the drawings or in the specification as being a preapproved alternative manufacturer.

B. A prior approval submittal package shall at a minimum consist of the following items:

1. One copy of the product submittal in accordance with the paragraph in this section titled SUBMITTALS.
2. Plan layouts sketches of mechanical rooms or systems of the substituted equipment showing that the proposed equipment will fit within the space allocated with the manufacturers and code required clearances for the substituted equipment as well as the other equipment in the space.
3. Indications of any structural modifications required for the proposed substitution, such as additional weight or opening size changes.

4. Indications of any electrical modifications required for the proposed substitution, such as changes in breaker sizes, wiring requirements.
5. Indication of any deviations from the specified equipment or their performance.

C. It shall be the Manufacturer and/or their authorized Representative's responsibility to verify that submitted substitute equipment will fit in space available. The Manufacturer and/or their authorized Representative's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but complete.

D. The Manufacturer and/or their authorized Representative's shall be responsible for the costs of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect of any and all other trades.

1.14. SUBSTITUTED PRODUCTS

A. Material or equipment specified by Manufacturer's name is being used as a basis of standard. No substitution is allowable without Engineer's written approval **FOURTEEN (14)** days prior to bid due date unless the manufacturer is listed on the drawings or in the specification as being a preapproved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.

B. It shall be the Contractor's responsibility to verify that submitted substitute equipment will fit in space available. The contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but complete.

C. The Contractor shall be responsible for the costs of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect of any and all other trades.

D. The Engineer may request detailed shop drawing or plan layouts of mechanical rooms or systems of the substituted equipment.

E. Should a substitution be approved by the Engineer (based upon the substitution submittal) and accepted, and should the substitute material or equipment prove defective, not meeting design parameters, or otherwise

unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

1.15. SAFETY

A. General – Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the “Occupational Safety and Health Standards” and the “Safety and Health Regulations for Construction”, state and federal.

B. According to OSHA, a hazardous chemical is any chemical, which is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a contractor produces, uses, or stores hazardous chemicals at the workplace, the contractor shall develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. In projects with multiple tenants in which the building is partially occupied during all or part of the project, Contractor shall inform the building manager or Owner, according to OSHA guidelines, of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified. Contractor shall employ required methods of training, information, handling, ventilation, labeling, storing, disposal, and removal of hazardous chemicals.

1.16. LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Refer to General Conditions for list of such independent testing authorities.

1.17. SITE VISIT REPORTS

A. During the course of the job, the Engineer will make site and inspection visits to observe work in progress and will subsequently prepare a written site visit report, which will be sent to the Contractor and to whomever else the engineer desires. The Contractor shall provide 48 hour written notice to the engineer for all testing and city inspection, so they can attend these inspections. The Contractor shall prepare a written and typed response within seven (7) calendar days of his receiving the site visit report. The Contractors shall accompany the engineer during this final punchlist visit upon the request of the Engineer. The General Contractor shall include in his response the following information.

1. Date of site visit by the Engineer,
2. Date of receipt of the site visit report,

3. Name and title of the preparer of the response,
4. An item number referenced to the site report,
5. A brief three or four word description of the item,
6. The Contractor or Subcontractor affected,
7. The proposed course of action, and
8. An expected time of completion of the action.

1.18. FINAL PUNCH REPORTS

A. At the completion of the job, the Engineer will make punchlist site visits to observe completed work and will subsequently prepare a written site visit punchlist report, which will be sent to the Contractor and to whomever else the Engineer desires. The Contractor upon completion of the listed punchlist items shall prepare a type written response to the list indicating completion of each item. The Contractor shall include in his response the resolution of each item. The Contractors shall accompany the Engineer during this final punchlist visit upon the request of the Engineer.

1.19. CUTTING AND PATCHING

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

B. Where it is necessary to cut through any non-structural elements of walls, floors, or ceilings to permit the installation of any work under this contract, or to repair any defects that may appear up to expiration of the guarantee, such cutting shall be done by the Contractor with as little damage as reasonably possible to the element being cut or to adjacent elements.

C. After the necessary work has been completed, the damage shall be repaired by the respective Contractor, who shall pay all costs of such cutting, repairs and patching. All patching or sealing of cuts and penetrations, including final appearance of same, shall be done to the approval of the Engineer.

D. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

1.20. INSURANCE

A. The Contractor shall have required insurance. Required insurance shall be provided by this Contractor for protection against public liability and property damage for the duration of work.

1.21. CONFLICTS AND CORRECTION OF WORK

A. Promptly correct work rejected or failing to conform to the requirements of the Contract, whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear cost of correcting such rejected and nonconforming work including additional testing and inspections and including compensation for observing mechanical and electrical engineering firm's services and expenses made necessary thereby.

B. If a conflict occurs on the bid documents, the Contractor shall contact the Engineer's offices with a written request for clarification. If the conflict is un-resolvable at the time of bid, the most expensive interpretation of the conflict shall be bid so the conflict can be resolved in a deductive manner at a later time if necessary.

C. If a conflict is discovered during construction, the Contractor shall stop work and that portion of the project and contact the appropriate party for clarification. The request for clarification shall be in written form. The Contractor shall bear the burden of replacing work that has been installed incorrectly as a result of a conflict on the drawings where he has not sought the Engineer's guidance for clarification.

D. If during construction a conflict is discovered between the drawings, the specifications, and/or the manufacturer's installation requirements the most stringent shall apply unless written clarification is obtained from the Engineer.

1.22. COORDINATION

A. In a timely manner, coordinated with all work involved for the following areas:

1. Where new work of three or more trades or subcontractors is installed.
2. Where new work is installed in existing areas.
3. Where lead times are critical to the project schedule.
4. Provide construction grade drawing as needed to acquire approval of work plan.
5. Access or service spaces required for HVAC and plumbing equipment.

B. Any occasion that requires the Engineer to be in attendance, the Contractor shall give the Engineer 24-hour notification.

PART 2 – PRODUCTS

2.1. MATERIALS

A. All materials shall be new and of specified quality, unless specifically noted otherwise. Materials shall be free from defects. Where manufacturer names are mentioned in the specifications or on the drawings, it has been done in order to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his material to and from the job site and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each day of work, each Contractor is responsible for covering or protecting his work and/or materials that may be susceptible to damage even if such damage is the result of unforeseen causes, e.g. an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced by Contractor at no cost to the Owner.

C. Contractor shall verify that all pieces of equipment will fit through available openings in the building and that all equipment can be installed without modification of building structure.

2.2. EQUIPMENT SCHEDULE

A. All equipment major items are specified in the equipment schedules on the drawings and shall be new and furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory installation.

B. Equipment items so noted will require start-up by factory-trained personnel. Equipment items so noted will require factory approved service personnel who shall provide all service, including all parts and all labor, as requested by the Owner, during the full period of equipment warranty.

2.3. EQUIPMENT RATINGS

A. Equipment capacities as scheduled on the drawings are at project site altitude. Capacities of submitted equipment must be corrected for project site altitude unless otherwise noted.

2.4. WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting and conduit shall be concealed unless otherwise noted, and

installed square to the building lines. Any work not meeting this requirement shall be replaced or rebuilt without extra expense to the Owner.

2.5. ELECTRICAL EQUIPMENT AND WIRING FOR MECHANICAL DIVISION

A. Responsibility

1. Unless otherwise indicated, all motors, conduit, wiring, and controls (including temperature) shall be furnished, set in place, and wired in accordance with the following schedule. (MD is Mechanical Division and ED is Electrical Division)

MECHANICAL-ELECTRICAL COORDINATION
TABLE 1

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	WIRED AND CONNECTED UNDER
6. Fire Sprinkler System Control – Supervisory Panels and devices, including tamper switches and flow switches	MD	MD(3)	ED
11. Fire and Smoke Duct Detectors	ED	MD	ED (3)

Notes:

2. If furnished as part of factory wired equipment, wiring, conduit, and connection only by ED
3. If float switches, line voltage thermostats, PE switches, time switches etc., carry the FULL LOAD CURRENT of any motor, they shall be furnished by the Mechanical Division, but shall be set in place, wired and connected by the Electrical Division, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, etc., they shall be set in place under the Mechanical Division and wired and connected by the Electrical Division. If they do not carry the FULL LOAD CURRENT to any motor they shall be furnished, set in place and wired under the Mechanical Division.
4. Wiring and conduit from alarm contacts to alarm system and conduit for control functions by ED; set in place and all control function wiring by MD.
5. Wiring and conduit from alarm contacts and kitchen equipment shutdown to kitchen fire suppression system by ED; all control functions by MD.

B. Connections

1. Connection to all control directly attached to ducts, piping and mechanical equipment shall be made with flexible connections not to exceed 3 linear feet.

2.6. ELECTRICAL WIRING AND CONTROL EQUIPMENT

A. All disconnects, motor starters, relays, wiring, conduits, etc. shall be provided by and comply with all requirements of 26 05 00 Sections of the electrical specifications.

B. The Mechanical Contractor must refer to the electrical control equipment and wiring shown on the Electrical Drawings. Any changes or additions required by specified equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.

C. All electrical equipment characteristics (voltage, phase, etc.) must be verified by the Contractor prior to ordering. It is imperative that voltage and phase characteristics are checked with the electrical drawings.

D. All motors shall be built in accordance with the current applicable IEEE, ASA and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion-proof when located in hazardous atmospheres. Type II weather-protected motors may be used in lieu of TEFC motors on roof fan units and similar equipment. Motors mounted in direct sun shall be provided with a shield to forbid direct radiation from the sun when the sun is 45 degrees or greater above the horizon.

E. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall have a service factor of 1.00 with total temperature rise of 65°C in the above conditions. Single-phase motors shall be NEMA Type N split phase induction motors with built-in thermal protectors. Single-phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors.

F. All motors shall be all copper wound, high power factor, high efficiency motors. Electric motors shall be an energy efficient type as defined in the latest edition of NEMA document no. MG1. Motor efficiency shall be made available to the Engineer as required.

2.7. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

2.8. EQUIPMENT AND PIPING SUPPORTS

A. All supporting systems for piping, equipment, and materials supported by the building structure shall be submitted to the Engineer for approval prior to purchase and installation.

2.9. ACCESSIBILITY

A. Access Panels

1. Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, plumbing fixtures such as trap primers and air gap fittings, or to other critical non-operating devices such as pull boxes, inspection parts, and gauges. Such access panels shall be provided and install by Contractor, whether or not shown on the drawings, and shall be brought to the attention of the Engineer for approval of type, color, fire rating. Where access is provided in rated members, the access panels shall be of a type that maintains the integrity of the member penetrated

B. Access to Equipment

1. All pipes, tubing, conduit, etc. including, but not limited to, draining piping of any type, electrical conduit, wiring not in conduit, and pneumatic control tubing shall be installed in such a way so as not to prevent and/or not to make necessary difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawlspaces), observation ports, measurement or balancing devices, junction boxes.
2. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Engineer is satisfied that access for the above purpose is achieved.

PART 3 – EXECUTION

3.1. STORAGE

A. Provide for proper storage of all materials and equipment and assume responsibility for losses due to any cause. All storage shall be within the contract limits of the building site or in a bonded warehouse. All equipment and materials must be covered and stored out of the elements; any item, which has become rusted, will not be permitted to be used.

B. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rainproof and lockable as required. Materials or equipment stored on site but not in a lockable rainproof storage facility shall be stored above ground or above slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaces at no cost to the Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

3.2. INSTALLATION AND ARRANGEMENT

A. Install all work to permit removal (without damage to other parts) of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves and drives, plumbing fittings, and all other parts which might require periodic replacement or maintenance. Arrange pipes, ducts and equipment to permit ready access to valves, traps, starters, motors, control components and to clear opens of doors and of access panels.

B. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping pipes whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, as required to affect these offsets, transitions and changes in direction.

C. Mechanical Contractor shall coordinate with other trade with regards to equipment going under mechanical equipment.

D. Mechanical Contractor shall install HVAC and plumbing equipment in a manner to provide the manufacturer's recommended service clearance and access space. The Mechanical Contractor shall be responsible for maintaining these clearances, coordinating them with the other trades and have installed work modified to maintain these clearances at no additional charge to the project or the Owner.

3.3. PROTECTION OF WORK AND PROPERTY

A. Where there are existing facilities, be responsible for protection thereof, whether or not such facility is to be removed or relocated or remain as installed. Moving or removing any facility must be done so as not to cause interruption the work or Owner's Operation.

B. All pipe and duct openings shall be closed with caps or plugs during installation. All fixtures shall be covered and protected against injury. At final completion, all work shall be cleaned and delivered in an unblemished condition or refinished and repainted at the desecration of the Engineer.

3.4. CONCEALED AND EXPOSED WORK

A. "Concealed" is intended to mean within such spaces as pipe chases, pipe trenches, above plaster ceilings, in walls and buried pipe is inaccessible when building is completed. "Exposed" is intended to be within equipment rooms, unfinished spaces, above "pushup" ceilings, accessible pipe tunnels, where pipe is accessible.

3.5. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify and coordinate locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.6. CONCRETE

A. This Contractor shall coordinate all requirements for concrete. All concrete shall be furnished under the Division 3 of these specifications.

B. For outdoor equipment on grade and indoor floor mounted mechanical equipment, the Contractor shall construct level 3000 psi concrete slabs with finished edges, wire reinforced, minimum 3 1/2" thick, and minimum 6" larger on all sides than the equipment being supported.

3.7. TRENCHING AND BACKFILLING

A. All excavation, trenching and backfilling required for the mechanical installation shall be provided by this Contractor. Excavation and backfilling shall be done in strict accordance with the specification section for trenching, excavation, and backfilling, see Division 2.

3.8. FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions and conditions governing work at the project site. He shall examine adjoining work on which his work is dependent, for perfect efficiency, and shall report any work, which must be corrected.

3.9. LUBRICATION

A. The Contractor shall provide all oil and grease for the operating of all equipment until acceptance. The Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the equipment. The Contractor shall protect all bearings and shafts during installation and shall thoroughly grease the steel shafts to prevent corrosion.

3.10. MANUFACTURER'S DIRECTION

A. The Contractor shall install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, the Contractor shall report such conflicts to the Engineer who shall make changes deemed necessary and desirable.

3.11. FLUSHING, CLEANING & STERILIZING

A. Clean ductwork under provisions of 01 70 00 and 23 31 00.

B. Before final connections are made in the piping systems, all piping shall be blown out with air and then completely washed out with cleaning compounds. The systems shall be flushed for complete removal of all foreign materials. Furnish all temporary connections, equipment, and valves required for this purpose.

C. After flushing, sterilize the domestic water systems with an approved chlorinating agent to provide a dosage on not less than fifty (50) ppm. After minimum contact period of twenty-four (24) hours, the system shall be flushed with clean water until the residual chlorine is no greater than the city water.

D. Refer to specific sections for testing requirements.

3.12. TESTS:

A. Tests shall be complete prior to final inspection and prior to covering with insulation or earth.

B. All pressure tests shall be charted using a stripe chart recorder with enough paper for the duration of the test shown. Refer to other specifications for additional requirements. The test results shall include test run, test date, person doing the testing, and Engineer or authority having jurisdiction signature.

C. All tests shall be witnessed and approved by the Engineer and the local authority having jurisdiction before covering or insulating. Provide Engineer with a minimum of [twenty -four (24) OR forty-eight (48)] hour written notice prior to any testing.

D. Test all storm drain, vent and waste lines with standing water test of twelve (12) feet of head. Test to be held for a minimum of six (6) hours.

E. Hydraulically test all heating water, steam piping, condensing water, chilled water, and drain piping before connecting to the units at one-hundred-fifty (150) psig hydrostatic pressure. Test to be held for a minimum of six (6) hours.

F. Hydraulically test all domestic cold, hot and recirculating hot water and soft water copper service lines at two-hundred (200) psig. Test to be held for a minimum of six (6) hours.

G. Hydraulically test all domestic cold, hot and recirculating hot water and soft water lines as follows:

1. While still accessible all piping shall be water pressure/leak tested to the manufacturer's standards. The Contractor shall pressure test the Aquatherm per the Manufacturer' requirements and per their form. Copies of these completed form are to be submitted for review by the Engineer and be included in the Operations and Maintenance Manuals.
2. Tests shall be carried out using water. The test pressure shall be as indicated in the pressure leak testing procedures required by the manufacturer.
3. Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines.

H. Hydraulically test all PROPRESS FITTING domestic cold, hot and recirculating hot water and soft water service lines as follows:
   1. Hydraulically test lines at eighty-five (85) psig to allow seating of the ProPress fitting's gaskets.
   2. Gasket seating test to be held for a minimum of one (1) hour.
   3. Then hydraulically test lines at two-hundred (200) psig.
   4. Full hydraulic test to be held for a minimum of six (6) hours.

I. Refrigerant Piping
   1. Leak test the system by charging the system to a pressure of ten (10) psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to five-hundred-fifty (550) psig with dry nitrogen. Seal any leaks that may be found and retest. Replace any mechanically attached fittings that leak with new fittings and retest.

   2. After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.

J. Hydraulically test all medical gas lines per NFPA 99 requirements.

K. Hydraulically test all RO, DI and DIR piping lines at one-hundred-fifty (150) psig and hold for six (6) hours.

L. Hydraulically test fire protection at two-hundred (200) psig. Test to be held for a minimum of six (6) hours.

M. Medical Gases: refer to Section 22 60 13 for testing requirements.

N. Air Pressure test all gas lines under air pressure at sixty (60) psig or one and one-half (1-1/2) time working pressure, whichever is greater. Test to be held for a minimum of twenty-four (24) hours.

O. Air Pressure test all duct systems to one and one-half (1-1/2) times the SMANCA designated pressure rating. Test to be held for a minimum of six (6) hours.

P. The satisfactory operation of blowers, pumps and other equipment with moving parts shall be demonstrated to the Engineer. Equipment without movable parts shall have pressure or other tests performed by the Contractor to demonstrate satisfactory operation.

Q. Furnish all instruments, pumps, blowers and equipment required for the testing.

R. Provide written approved copies of these test reports for inclusion on the Operations and Maintenance Manuals and submit one copy to the Mechanical Engineer.

3.13. PAINTING

A. Surfaces of all equipment and material not provided with a factory finish coat shall be thoroughly cleaned, primed (if not factory primed) and finish coated with a high quality alkyd industrial enamel of a color chosen by the Owner.

3.14. SPECIAL OPENINGS

A. The contractor shall attempt to schedule delivery of all large equipment requiring special openings for installation prior to enclosing of area. Where this is not possible written notice of required openings which must be provided shall be listed by size and location and submitted to the General Contractor prior to enclosing of areas involved. Work required to construct openings and the associated cost of enclosing them shall be done at no additional cost to the Owner.

3.15. PLACING IN OPERATION

A. All ducts, pipes, equipment, controls, hangers and supports shall be cleaned of plaster and other foreign debris.

B. Before final acceptance, all strainers shall be thoroughly cleaned or replaced, all bearings shall be oiled or greased, and all drains shall be cleaned out and primed. All permanent filters shall be cleaned; throwaway type filters shall be replaced with new filters.

C. The systems shall be placed in operation.

D. The contractor shall verify that all controls are set to meet operating conditions specified.

1. Example: Boiler operating control set at 200° F. Limit control set at 220° F.

E. The Contractor shall verify that all pieces of equipment are operable and that all sequences of controls are being met.

F. Contractor to adjust seating through the first (1st) year as required by Engineer.

3.16. BALANCING, TESTING AND ADJUSTING THE MECHANICAL SYSTEMS

A. Balancing the mechanical systems shall be part of this contract, refer to subsequent mechanical specification section for details. This Contractor is to include in their bid the cost of balancing, testing and adjusting.

3.17. OPERATION AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide a minimum of four (4) copies of operating and maintenance manuals. Contractor shall deliver four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain, but not limited to, the following general sections:

1. Certificates of acceptance from the inspecting authorities including approval of backflow preventer installation and certification,
2. Waiver of all liens if required by Division 1 requirements,
3. Warranties with starting dates and end dates for each pieces of equipment and/or for each system (warranties shall begin on date of substantial completion and acceptance by the Owner),
4. Names, telephone and fax numbers and addresses of all subcontractors, vendors, manufacturer's representatives, and warranties providers, (On Contractor's letterhead stationary),
5. Certification letters from each Contractor that each system furnished and installed by that contractor and/or subcontractors is started-up, balanced, adjusted and checked for proper operation in accordance with the intent of the contract documents,
6. Spare parts lists for each piece of equipment,
7. Lubrication charts showing type of lubrication and application methods and frequencies,
8. Filter cleaning or replacement schedule (On Contractor's letterhead stationary),
9. Preventative maintenance schedule for checking all items such as belt drives, safety controls, oil and refrigerant charges, and seasonal changer over recommendations. Cleaning of all strainers, traps, coils, tower pans, tubes, sprays, etc. (on Contractor's letterhead stationary),

10. Normal operating instructions including a sequence of operations (on Contractor's letterhead stationary),
11. Instructions as to procedures to be followed for emergency situations, such as alarms or safety items being tripped. (on Contractor's letterhead stationary),
12. Instruction on who to call for service during guarantee period, (on Contractor's letterhead stationary),
13. Include copies of all start-up reports on the equipment.
14. Include copies of sewer line cleaning report as required by Section 22 13 16.
15. Include copies of Valve Tag Lists.
16. Complete AS-BUILT temperature control diagrams including written control descriptions, system sequence of operations, schematics, parts or component lists, and operating instructions shall also be provided. In addition, one copy of the schematic pneumatic and/or electrical control diagrams shall be framed under glass and mounted on an equipment room wall in the vicinity of the installed equipment. Coordinate with requirements in the control [and commissioning] specifications
17. Approved copy of the Testing, Adjusting and Balancing Reports,
18. Copies of As-Built drawings on reproducible vellum as produced by a Xerox or photographic process or on CD or DVD and,
19. Copies of all **APPROVED** shop drawing submittals including nameplate date, design parameters, name, telephone and fax numbers, address of vendor, manufacturer's representative and warrantee provider.

C. Approval will not be given for final payment until the tests, balancing, and operating instruction portions have been completed.

D. Coordinate with commissioning specifications for additional requirements concerning operations and maintenance instructions.

3.18. INSTRUCTIONS TO THE OWNER

A. Contractor shall instruct the Owner's operating personnel in the operations and maintenance of all mechanical systems and equipment. There shall be a minimum of four (4) hours of training. Contractor shall furnish any special servicing tools required for maintenance.

B. Contractor shall conduct a demonstration of 'the installation upon completion and final acceptance of the work. There shall be a minimum four (4) hour demonstration. Prior to this all work shall have been completed, tested, balanced and placed in operation. Qualified personnel must be present at the demonstration to operate all the systems and prove

the performance of the equipment. The schedule for this demonstration shall be coordinated with the Engineer.

3.19. INSTALLATION CHECK

A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated below shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. IN each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Manufacturer's Representative and Engineer.

B. Each equipment supplier's representative shall furnish to the Engineer a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated satisfactorily.

1. Equipment Requiring Installation Check:
   a). Reduced Pressure Backflow Preventer
   b). Drinking Fountains
   c). Electrical Water Coolers
   d). Water Heaters
   e). Chillers
   f). All Pumps
   g). Water Boiler
   h). Domestic Hot Water Heaters
   i). Recovery System
   j). Rooftop Air Handling Units
   k). Air Filters
   l). Exhaust Fans
   m). Air Terminal Units, Constant and Variable Volume
   n). Vibration Isolators
   o). Fan Volume Control System
   p). Water Treatment Solutions

3.20. OPERATIONAL TEST

A. After completion of testing, adjusting and balancing work (see related specification section) the Contractor shall perform an operating test covering all equipment furnished and installed under Division 22. This test shall cover a period of not less than 24 hours. The Contractor shall have all of his equipment operating and check all equipment for adjustments. The

Contractor will instruct the Owner's operating personnel in the operation and maintenance the system following this operational test. The operational test shall be a demonstration of the operation of the systems in all specified modes. Operational test shall be conducted by the Contractor with the assistance of the Testing and Balancing Sub-Contractor. Tests as required shall be conducted in the presence of the Owner and the Mechanical Engineers. Coordinate operation testing with requirements in other specification sections.

3.21. INTERRUPTING SERVICES

A. The Contractor shall coordinate the installation of all work within the building in order to minimize interference with the operation of existing mechanical, plumbing, and utility systems during construction. Connections to existing systems requiring the interruption of services within the building shall be carefully coordinated with the Owner to minimize system downtimes. Requests for the interruption of existing services shall be submitted to the Owner, and/or Engineer in writing a minimum of two (2) weeks before the scheduled date. Absolutely no interruption of the existing services will be permitted without the written approval of the Owner and/or Engineer.

3.22. CONSTRUCTION POWER

A. Electrical power for conducting construction activities shall be acquired as indicated by Engineer and carefully coordinated with Owner's personnel.

END OF SECTION 22 05 00

SECTION 22 05 13 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 21 and 22 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Labeling and identifying mechanical systems and equipment is specified in Section 23 05 53 "Mechanical Identification."
5. Nonshrink grout for equipment installations.
6. Field-fabricated metal and wood equipment supports.
7. Installation requirements common to equipment specification Sections.
8. Cutting and patching.
9. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.3. DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4. SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for following piping specialties:

1. Mechanical sleeve seals.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Coordination drawings for access panel and door locations.

E. Prepare coordination drawings according to Division 1 Section "Submittals" to a 1/4 inch equals 1 foot (1:48) scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
   a) Planned piping layout, including valve and specialty locations and valve stem movement.

1.5. QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

B. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.6. DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.7. SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in this Section."

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.1. PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2. JOINING MATERIALS

A. Refer to individual piping system specification Sections in Divisions 21, 22, and 23 for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
   a) Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
   b) Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.

2. ASME B16.20 for grooved, ring-joint, steel flanges.

3. AWWA C110, rubber, flat face, 1/8-inch-thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.3. PIPING SPECIALTIES

A. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at an 180° F temperature.
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.
5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225°F temperature.
7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded,

or grooved end types and 300-psig working pressure at 225°F temperature.

B. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber-sealing elements to expand when tightened.

C. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 24-gage or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
   a) Penetrating Pipe Deflection: 5 percent without leakage.
   b) Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket, conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
   c) Pipe Sleeve: AWWA C151, ductile-iron pipe.
   d) Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
   a) Underdeck Clamp: Clamping ring with setscrews.

2.4. GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

2.5. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

PART 3 – EXECUTION

3.1. PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Divisions 21 and 22 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Coordinate excavation, trenching, and backfilling requirements necessary to accomplish mechanical work with those respective sections in Division 2.

D. Coordinate the thickness of the wall to accommodate the concealed piping and its associated insulation, if required. I.E., 4 inch sewer or vent line required a 6 inch thick wall.

E. Install piping at indicated slope.

F. All pipes, ducts, and conduit shall be hung as high as possible. Electrical work shall be hung above other work.

G. Exact location of electric outlets, piping, ducts, and the like shall be coordinated to avoid interferences between lighting fixtures, piping, ducts, structural elements, and similar items.

H. Install components having pressure rating equal to or greater than system operating pressure.

I. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

J. Install piping free of sags and bends.

K. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

L. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

M. Install piping to allow application of insulation plus 1-inch clearance around insulation.

N. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

O. Install fittings for changes in direction and branch connections.

P. Install couplings according to manufacturer's printed instructions.

Q. Sleeves are required for core drilled holes.

R. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

S. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
   a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
2. Build sleeves into new walls and slabs as work progresses.
3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a) Steel Pipe Sleeves: For pipes smaller than 6 inches.
   b) Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
   c) Cast-Iron Sleeve Fittings: For floors having membrane

waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 4 inches above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal."

(1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."

T. Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

1. Install steel pipe for sleeves smaller than 6 inches.
2. Install cast-iron wall pipes for sleeves 6 inches and larger.
3. Assemble and install mechanical seals according to manufacturer's printed instructions.

U. Below Grade, Exterior Wall, and Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

V. Protection of Penetrations

1. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

2. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."

W. Verify final equipment locations for roughing in.

X. Refer to equipment specifications in other Sections for roughing-in requirements.

Y. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
   a) Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b) Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
   c) Align threads at point of assembly.
   d) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e) Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. No union shall be placed in a location which will be inaccessible after completion of the project.
9. A union or flange shall be installed so equipment may be readily disconnected:
   a) On each side of each control valve, regulator, and similar items.
   b) On one side of each check valve and each trap.
   c) At all connections to pieces of equipment such as chillers, boilers, pumps, compressors, tanks, and similar items

Z. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
2. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

AA. Access To Valves

1. Valves, bearings, and other operating parts located in equipment rooms, installed more than 6'-6" to center line above the floor or platform or are not readily accessible due to the proximity of the other equipment shall be provided with chain wheels, extension stems, extension oil pipes, and similar devices. The above provision does not apply to finished spaces.

3.2. EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment, giving right-of-way to piping systems installed at a required slope.

F. Provide means for making adjustments to mechanical equipment without bending, springing, or otherwise deforming any part (items such as belt drives, damper linkages, and pulleys). Adjustments shall incorporate set-screws or similar means for positive settings.

3.3. PAINTING AND FINISHING

A. Refer to Division 09 00 00 Section "Painting" for field painting requirements.

B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4. CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.5. ERECTION OF METAL SUPPORTS AND ANCHORAGE

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

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.6. ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7. DEMOLITION

A. Disconnect, demolish, and remove work specified under Divisions 21 and 22 and as indicated on the drawings.

B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8. CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.9. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.10. GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION 22 05 13

SECTION 22 07 19 – PIPING INSULATION

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2. RELATED SECTIONS

A. Division 7 – Firestopping.

B. Section 09 91 00 – Painting: Painting insulation jacket.

C. Section 23 05 53 – Mechanical Identification.

D. Section 22 11 16 – Plumbing Piping: Placement of hangers and hanger inserts.

1.3. REFERENCES

A. Section 01 45 00 – Quality Control, 01 42 19 – Reference Standards and 22 05 00 – General Mechanical Requirements: Requirements for references and standards.

B. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]).

C. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

D. ASTM C195 – Standard Specification for Mineral Fiber Thermal Insulating Cement.

E. ASTM C240 – Standard Test Methods of Testing Cellular Glass Insulation Block.

F. ASTM C449/C449M – Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

G. ASTM C518 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

H. ASTM C533 – Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

I. ASTM C921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

J. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

L. NAIMA National Insulation Standards.

M. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.

N. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.4. SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals: Procedures for submittals and Section 22 05 00 – General Mechanical Requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5. SUBMITTALS FOR INFORMATION

A. Section 01 33 00 – Submittals: Procedures for submittals and Section 22 05 00 – General Mechanical Requirements.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7. REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, and UL 723.

1.8. DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 – Material and Equipment: Transport, handle, store, and protect products.

B. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.9. ENVIRONMENTAL REQUIREMENTS

A. Section 22 05 13 – Basic Mechanical Material and Methods: Environmental conditions affecting products on site.

B. Maintain ambient conditions required by manufacturers of each product.

C. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 – PRODUCTS

2.1. MANUFACTURER:

A. Johns Manville.

B. Owens Corning.

C. Knauf.

D. ARMAFLEX

E. Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 – General Mechanical Requirements.

2.2. GLASS FIBER

A. Insulation: ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C177, 0.24 at 75°F
2. Maximum service temperature: 650°F.
3. Maximum moisture absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket:

1. ASTM C921, White Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

E. Insulating Cement/Mastic:

1. ASTM C195; hydraulic setting on mineral wool.

F. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz. /sq. yd. weight.
2. Blanket: 1.0 lb. /cu ft. density.
3. Weave: 10x10.

G. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz. /sq. yd. weight.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

H. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Outdoor Breather Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Insulating Cement:

1. ASTM C449/C449M.

2.3. HYDROUS CALCIUM SILICATE

A. Insulation: ASTM C533; rigid molded, asbestos free, gold color.

1. 'K' value: ASTM C177 and C518; 0.40 at 300ºF.
2. Maximum service temperature: 1200ºF.

3. Density: 15 lb. /cu ft.

B. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

C. Insulating Cement:

1. ASTM C449/C449M.

2.4. JACKETS

A. ABS Plastic:

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a). Minimum service temperature: -40°F.
   b). Maximum service temperature of 180°F.
   c). Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
   d). Thickness: 30 mil.
   e). Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 [ASTM B209M].

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Section 01 31 00 – Coordination and Meetings: Verification of existing conditions before starting work.

B. Verify that piping has been tested before applying insulation materials.

C. Verify that surfaces are clean and dry, with foreign material removed.

3.2. INSTALLATION

A. Section 01 45 00 – Quality Control: Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140°F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:

1. Application: Piping 1 inch diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
6. Support Hanger or clamp shall be located outside the insulation per schematic on drawings.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 27 00.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): aluminum jacket.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.4. SCHEDULES

A. Plumbing Systems:

1. Domestic Cold Water Supply:
   a). Glass Fiber Insulation:
      1). Pipe Size Range: ALL.
      2). Thickness: 1.00 inch
   b). Hydrous Calcium Silicate Insulation:
      1). Pipe Size Range: ALL.
      2). Thickness: 1.00 inch

END OF SECTION 22 07 19

SECTION 22 11 16 – PLUMBING PIPING

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Domestic water piping system.

1.2. RELATED SECTIONS

A. Section 31 23 16 -Trenching and Backfilling.

B. Section 23 05 53 - Mechanical Identification.

C. Section 23 21 16 - Piping Insulation.

D. Section 22 11 19 - Plumbing Specialties.

1.3. REFERENCES

A. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

B. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.

C. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

D. ASTM B32 - Solder Metal.

E. ASTM B42 - Seamless Copper Pipe.

F. ASTM B75 - Seamless Copper Tube.

G. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube.

H. AWS A5.8 - Brazing Filler Metal.

1.4. SUBMITTALS

A. Submit under provisions of Section 01 33 00 and 22 05 00.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5. PROJECT RECORD DOCUMENTS

A. Submit under provisions of Sections 01 78 39 and 22 05 00.

B. Record actual locations of valves.

1.6. OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Sections 01 78 23 and 22 05 00.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7. QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Maintain one copy of each document on site.

1.8. QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by the manufacturer.

1.9. REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Texas and City of El Paso plumbing code.

B. All items shall be lead free per the Reduction of Lead in Drinking Water Act 2014.

C. Conform to applicable code for installation of backflow prevention devices.

D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

E. At the end of warranty period the Contractor shall perform a Backflow Inspection per the requirements of the El Paso Plumbing Codes and shall turn a copy over to the Owner and a copy to El Paso Water Utility per their requirements.

1.10. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Sections 01 60 00 and 22 05 00.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11. ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.12. EXTRA MATERIALS

A. Furnish under provisions of Sections 01 78 46 and 22 05 00.

B. Provide two repacking kits for each size valve.

PART 2 – PRODUCTS

2.1. WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type K hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA or AWS A5.8, BCuP silver braze.

2.2. WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type K hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA or AWS A5.8, BCuP silver braze.

2.3. WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA. The item shall be lead free.

2.4. FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under:

1. Ferrous pipe: 150 psig malleable iron threaded unions.
2. Copper tube and pipe: 150 psig bronze unions with soldered joints. The item shall be lead free.

B. Pipe Size Over 2 Inches:

1. Ferrous pipe: 150 psig forged steel slip-on flanges; 1/16 inch thick preformed neoprene gaskets.
2. Copper tube and pipe: 150 psig slip-on bronze flanges; 1/16 inch thick preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.5. BALL VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Grinnell Corp.
4. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to and including 2 Inches: Bronze two piece body, stainless full ported steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union. The valve assembly shall be lead free.

C. Over 2 Inches: Cast steel body, chrome plated full ported steel ball, teflon seat and stuffing box seals, lever handle, flanged. The valve assembly shall be lead free.

2.6. BUTTERFLY VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Grinnell Corp.
4. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, infinite position lever handle with memory stop. The valve assembly shall be lead free.

C. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, wafer or lug ends, extended neck, infinite position lever handle with memory stop. The valve assembly shall be lead free.

2.7. SWING CHECK VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Grinnell Corp.
4. Red-White Valve Corp.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to and including 2 Inches: Bronze swing disc, threaded ends. The valve assembly shall be lead free.

C. Over 2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends. The valve assembly shall be lead free.

2.8. SPRING LOADED CHECK VALVES

A. Manufacturers:

1. NIBCO.
2. Milwaukee.
3. Grinnell Corp.
4. Red-White Valve Corp.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, or flanged ends. The valve assembly shall be lead free.

2.9. WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Wilkins/Zurn.
2. Watts Model.
3. Febco Model.
4. Beeco Model.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Up to 2 Inches: Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union ends. The valve assembly shall be lead free.

C. Over 2 Inches: Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged. The valve assembly shall be lead free.

2.10. RELIEF VALVES

A. Manufacturers:

1. Bell & Gossett.
2. Sparco Inc.

3. Watts Regulator Corp.
4. Wilkins.
5. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled. The valve assembly shall be lead free.

2.11. STRAINERS

A. Manufacturers:

1. Wilkins.
2. Grinnell Corp.
3. Watts Regulator.
4. Mueller Steam Specialty.
5. Hoffman.
6. Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.

B. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen. The item shall be lead free.

C. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen. The item shall be lead free.

2.12. BACKFLOW PREVENTER VALVES

A. Reduced Pressure Backflow Preventer

1. Manufacturers:
   a) Wilkins/Zurn Model 375XL.
   b) Watts Model 909.
   c) Febco Model 825.
   d) Beeco Model 12.
   e) Danfoss RPZ.
   f) Refer to Sections 22 05 13 – Basic Mechanical Material and Methods and 22 05 00 – General Mechanical Requirements: For Product options and substitutions.
2. Under 1-1/2 Inches: ANSI/ASSE 1013, and AWWA C506; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm

type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two OS&Y gate valves, strainer, and four test cocks. The valve assembly shall be lead free.

3. 2 inch and Over: ANSI/ASSE 1013, and AWWA C506, Cast iron body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate OS&Y valves, strainer, and four test cocks. The valve assembly shall be lead free.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Verify excavations under provisions of Division 31.

B. Verify that excavations are to required grade, dry, and not over-excavated.

C. The drawings indicate the locations, type and sizes of various utilities within the site where known. These utilities are indicated as accurately as possible. If the Contractor encounters any utilities or differing conditions during construction, which are not shown on the drawings, they shall request in writing for written instructions from the Architect and/or Engineer

D. Contractor shall verify location, size, elevation, pressure and any other pertinent data of the existing utilities. The Contractor shall provide a written report with drawings indicating this existing utilities information, such as utility locations and sewer invert information.

3.2. PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. [Coordinate size and location of access doors with Section 08 31 13.]

I. Establish elevations of buried piping outside the building to ensure not less than 2.0 ft. of cover.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare, clean, and prime pipe, fittings, supports, and accessories not pre-finished and ready for finish painting.

M. Excavate in accordance with Section 31 23 16 for work of this Section.

N. Backfill in accordance with Section 31 23 16 for work of this Section.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted.

Q. Piping shall be supported at 6 feet on center and at both sides of changes in direction with factory fabricated roof supports. Flash supports into roof per roofing manufacturer recommendations.

3.4. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or

smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.5. APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball or butterfly valves for throttling, bypass, or manual flow control services.

3.6. ERECTION TOLERANCES

A. Slope water piping and arrange to drain at low points.

3.7. DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Refer to Section 22 05 00 for additional information.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from [10] [5] [2] percent of outlets and from water entry, and analyze in accordance with AWWA C651.

J. Provide copy of sample report to the engineer. Include a copy of the sample report in each of the Owner's Manuals, refer to Section 15000.

3.8. SERVICE CONNECTIONS

A. Provide new water service complete with existing reduced pressure backflow preventer and water meter with by-pass valves.

1. Provide sleeve in wall for service main and support at wall with Reinforced Concrete Bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
2. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.
3. At the end of warranty period the Contractor shall perform a Backflow Inspection per the requirements of the El Paso Plumbing Codes and shall turn a copy over to the Owner and a copy to El Paso Water Utility per their requirements.

END OF SECTION 22 11 16

SECTION 23 05 53 – MECHANICAL IDENTIFICATION

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Tags

B. Pipe Markers.

1.2. RELATED SECTIONS

A. Section 09 91 00 – Painting: Identification painting.

1.3. REFERENCES

A. Section 01 45 00 – Quality Control and 01 42 19 – Reference Standards: Requirements for references and standards.

B. ANSI/ASME A13.1-2015 – Scheme for the Identification of Piping Systems.

1.4. SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals: Procedures for submittals.

B. Section 22 05 00 – General Mechanical Requirements for submittals.

C. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

E. Product Data: Provide manufacturers catalog literature for each product required.

1.5. SUBMITTALS FOR INFORMATION

A. Section 01 33 00 – Submittals: Procedures for submittals.

B. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

1.6. SUBMITTALS AT PROJECT CLOSEOUT

A. Section 01 70 00 – Contract Closeout and 01 78 23 – Operation and Maintenance Data: Procedures for submittals.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers, associated system, function, normal position, and type.

C. Valve Tag Chart.

1.7. EXTRA MATERIALS

A. Sections 01 70 00 – Contract Closeout and 01 78 23 – Operation and Maintenance Data.

PART 2 – PRODUCTS

2.1. VALVE TAGS

A. Metal Tags:

1. Manufacturers:
   a) Seton.
   b) USA Brady.
   c) Panduit.
   d) Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 – General Mechanical Requirements.
2. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter with smooth edges.

B. Tag Chart: Typewritten letter size list in anodized aluminum frame and plastic laminated.

2.2. NAMEPLATES AND LABELS

A. Manufacturers:
1. Seton.
2. USA Brady.
3. Panduit
4. Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 – General Mechanical Requirements.

B. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

C. Locations:

1. Each mechanical equipment.

D. Letter Size:

1. 1/8-inch letters for identifying individual equipment and loads.
2. 1/4-inch letters for identifying grouped equipment and loads.

E. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background. Use only for identification of individual wall switches and receptacles and control device stations.

2.3. PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:
   a) Seton.
   b) USA Brady.
   c) Panduit
   d) Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 – General Mechanical Requirements.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:
   a) Seton.
   b) USA Brady.
   c) Panduit
   d) Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 – General Mechanical Requirements.
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:
   a) Seton.

b) USA Brady.
c) Panduit
d) Substitutions: Refer to Section 22 05 13 – Basic Mechanical Material and Methods and Section 22 05 00 - General Mechanical Requirements.

2. Bright colored continuously printed plastic ribbon tape with magnetic strip, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 – EXECUTION

3.1. PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2. INSTALLATION

A. Section 01 45 00 – Quality Control: Manufacturer's instructions.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Identify valves in main and branch piping with tags.

G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 23 05 53

SECTION 26 05 00 – ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

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

1.2. DESCRIPTION OF WORK:

A. Drawings: Refer to the E-series drawings for graphic representations, schedules and notations showing electrical work.

B. Specifications: Refer to the Division 26 sections for the primary technical specifications of electrical work.

C. This work includes furnishing and installing all electrical material, accessories, supports, conduit, wire, connections, grounding, excavating and all other labor and materials indicated on the drawings or specified herein and required by codes. This includes all electrical materials and connections required for operation of all items of equipment furnished under other sections of these specifications. For clarity some items may be noted as "BY ELECTRICAL CONTRACTOR" or "IN THIS CONTRACT".

D. Work Included:

The work under this section is not limited to, but shall include:

1. Electric service conduits and cables and utility company service charges.
2. Coordinate with electrical utility company and provide metering facilities to comply with utility company requirements.
3. Coordinate with telephone company and provide telephone service conduits to comply with telephone company installation requirements.
4. Trenching, excavating and backfilling for electrical work.
5. Permit, plan check and inspection fees.
6. Any fees or assessments required by local authorities are a part of the electrical contract.
7. Main metering switchboard, panelboards and feeders for a complete power and lighting distribution system.
8. Lighting fixtures, lamps, outlet boxes, conduit, wiring devices, control components, buck-boost transformers, powers supplies for low-voltage lighting fixtures, and accessories.
9. Conduit, wiring and connections for all line voltage electrical equipment furnished and installed by others (see Mechanical, Refrigeration, Fire Control drawings).

10. Conduit and wire for low voltage controls. Final connections by electrical contractor.
11. Conduit and wire for public sound system.
12. Starters and disconnects for all fan motors. These shall include all components to make shunting under hoods fully operational.
13. Contractor shall submit shop drawing for circuits that will disconnect power to all equipment under kitchen hoods.
14. Installation of ceiling fans by ELECTRICAL CONTRACTOR.
15. Public telephone wiring and instruments
16. Motors.
17. Connection of low voltage wiring to air conditioning controls (except as shown on plans).
18. Public sound system.
19. Occupancy sensor low voltage circuits/power paks.

E. Equipment provided under other sections, but connected under this section:

1. Mechanical.
2. Food service equipment.
3. Signs.

1.3. BIDDING

A. All electrical equipment shall be new unless specified otherwise in the specifications or on the drawings.

B. All bids must be based only on the equipment and materials as scheduled on the drawings and as specified or on equivalent equipment and materials from a pre-approved alternative manufacturer. No bid may be based on a substituted or other alternative without specific written prior approval from the Engineer. Any Contractor who assumes equivalence of products and who bases his bid on that assumption does so at his own risk.

C. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternative to the scheduled items; it merely means that for bidding prior approval is not required. All fixtures and devices must still be submitted according to the prescribed procedures. In addition, some items that have an important visual affect, e.g. electric water coolers, may be required to receive Owner's or Architectural approval also.

1.4. COORDINATION OF ELECTRICAL WORK:

A. General: Refer to the Division 1 sections for general coordination requirements applicable to the entire work. It is recognized that the contract documents are diagrammatic in showing certain physical relationships, which must be

established within the electrical work, and in its interface with other work including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Electrical Subcontractor.

B. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction, and with a minimum of 8'-0" overhead clearance where possible.

C. The electrical plans are diagrammatic, but shall be followed as closely as actual construction and the work of the other trades will allow. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.

D. The maximum number of circuits combined in one raceway shall be three; however, no circuit shall be combined without prior approval of the Engineer or unless specifically shown on the drawings.

E. The Electrical Subcontractor shall not combine circuits not shown to be combined. Furthermore, this electrical subcontractor shall not extend circuits, shown on the drawings as routed in the floor, overhead or extend circuits, shown on the drawings as routed overhead, in the floor, without first obtaining approval from the Engineer. This electrical subcontractor shall not prepare and/or use electrical subcontractor prepared rough-in drawings without first obtaining approval from the Engineer.

F. Where unauthorized design changes are found, the work shall be disapproved and the contractor shall remove the work and extend it as shown on the Drawings.

G. The Electrical Contractor shall coordinate the installation of electrical conduits with any cable tray to maintain required clearances.

1.5. QUALITY ASSURANCE AND STANDARDS:

A. General: Refer to Division 1 for general administrative/procedural requirements related to compliance with codes and standards. Specifically, for the electrical work (in addition to standards specified in individual work sections), the following standards are imposed, as applicable to the work in each instance:

1. ANSI C 2, National Electrical Safety Code.
2. NECA standards for installation.
3. NEMA standards for materials and products.

1.6. LAWS, CODES AND ORDINANCES:

A. All work and material shall conform to the requirements of OSHA and all national and state Laws and ordinances having jurisdiction at the job site. The (NEC)

National Electrical Code, 2008 Edition, or latest edition being enforced, shall be strictly adhered to. NEC requirements are considered "minimum requirements". Where requirements of the contract documents exceed NEC, the contract documents govern.

B. Secure permits and pay permit and inspection fee as required by local authorities.

C. Upon completion of the work, furnish to the Owner a certificate of final inspection and approval from the electrical inspection bureau having jurisdiction.

D. All electrical systems shall be grounded in strict accordance with the requirements of the National Electrical Code.

1.7. INDUSTRY PUBLICATION STANDARDS:

A. The publications and standards of the latest issue at the time of bid, of the following organizations, where referenced in these specifications or on the drawings, shall apply:

1. ANSI-American National Standards Institute
2. ASTM-American Society of Testing and Materials
3. CBM-Certified Ballast Manufacturers Association
4. IEEE-Institute of Electrical and Electronic Engineers
5. IPCEA-Insulated Power Cable Engineers Association
6. NEC-National Electrical Code
7. NECA-National Electrical Contractors Association
8. NEMA-National Electrical Manufacturers Association
9. NESC-National Electrical Safety Code
10. NFPA-National Fire Protection Association
11. UL-Underwriters Laboratory
12. IESNA-Illuminating Engineering Society of North America

1.8. EXISTING UTILITIES

A. The drawings indicate the locations, type and sizes of various utilities within the site where known. These utilities are indicated as accurately as possible. If the Contractor encounters any utilities or differing conditions during construction, which are not shown on the drawings, they shall request in writing for written instructions from the Architect and/or Engineer. Any relocation or remodeling required will then be directed by a change order. This Contractor shall assume all responsibility for protection of all utilities, shown or not, and for repair required by this construction.

B. Contractor shall verify location, size, elevation, and any other pertinent data of the existing utilities. The Contractor shall provide a written report with drawings indicating this existing utilities information, such as utility locations information.

Additional costs incurred due to failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by the Contractor.

C. All costs associated with providing utilities including, but not limited to, connection fees, meters, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by the utility company.

D. Submission of a bid by the Contractor shall be considered an acknowledgment by the contractor of his compliance with this section.

E. The Contractor shall coordinate with Owner, Architect, and this Engineer's office any work that has the potential to hinder electrical services to areas outside this contract. All shut downs or tie-ins relating to these systems shall be scheduled and submitted in writing to be approved by the Owner, Architect, and this Engineer's office. Contractor shall submit in writing a schedule of construction phasing that indicates areas of first priority during each phase and anticipated completion times. Schedules shall be submitted a minimum of 7 days prior to commencing work. Owner, Architect, and this Engineer's office shall review these schedules and notify the contractor of acceptance prior to commencement of work.

1.9. DRAWING AND DRAWING CONFLICTS

A. Contract drawings are diagrammatic only and are not intended to be scaled for dimensions. All dimensions shall be taken from Architectural drawings, certified equipment drawings and from the structure itself before fabricating and work. All space requirements shall be verified, coordinated with other trades, as it is the various Contractors' responsibility to install the systems complete in the space provided without extra charges to the Owner.

B. It is intended that anything, including labor and materials, which is usually furnished as part of any equipment specified and which is necessary for operation shall be furnished as part of the Contract without additional cost, whether or not shown or described.

C. All piping in finished areas of the building shall be concealed except where otherwise noted on the drawings.

D. All equipment shall be installed in accordance with manufacturer's recommendations, unless approval is given in writing be the Consulting Electrical Engineer for deviation prior to commencement of work.

E. In the event of a conflict or inconsistency between items indicated on the drawings and in the specifications or conflicts with code requirements applying to the same

item, that drawing indication, note, specification or code which prescribes and establishes the higher standard, provides for a better grade of material or provides a more complete job shall take precedence. The Contractor shall notify Engineer and Architect to obtain a clarification.

F. All materials not approved by Engineer and Architect and all material not properly installed, shall be promptly removed from the premises by the Contractor, whether or not it has been incorporated into the work. The Contractor shall then promptly replace and reconnect all work in accordance with the drawings and specifications, at his own expense, and shall also bear the expense of restoring all work of other trades damaged or dislocated by such removal or replacement.

G. Should the Contractor refuse to remove and replace unsatisfactory materials and installation, and restore work of other trades after having been notified by Engineer and Architect, then Engineer/Architect and owner shall have the right to enter upon the work and procure such materials and labor required to remove and replace all unsatisfactory work and restore work of other trades, in order to complete the project. All costs incurred by Owner/Engineer/Architect for such corrective work shall be borne by the Contractor.

H. Submittals shall indicate minimum access and service clearances for the submitted equipment.

1.10. STRUCTURAL CONDITIONS - SPECIAL NOTE

A. Where conduits, sleeves, inserts, supports, cabinets, fixtures and other material are to be attached to, pass through, or interfere with, any structural member, or where notching, boring or cutting of any structural member is necessary, or where special openings are required through floors, footings, foundations, walls, roofs, or other structural elements to accommodate the electrical work, this Contractor shall obtain the approval of Owner/Engineer/Architect and shall coordinate all such work with the General Contractor, and other trades. The Electrical Contractor shall perform all such work and shall patch and repaint all members and surfaces damaged or soiled in performing the electrical installation, unless specifically instructed otherwise.

B. Where conduits pass through walls or foundations, seal around conduits to make the work watertight. Where conduits pass through roofs, provide galvanized metal flashing and seal with a suitable compound, intended for the purpose to make the work watertight.

C. See schematics and plans for conduits through roof on Architectural and M/E/P drawings.

1.11. WARRANTY

A. All materials and equipment shall be new unless otherwise specified.

B. Guarantee all workmanship, material and equipment and replace any found defective without cost to the Owner, for ONE year after final acceptance, as defined in General Conditions.

C. Each warranty for longer than one year as described above (that comes with equipment used on the job) shall be passed into the Owner in the Operation and Maintenance Manual, along with the dates of start and end of warranty.

D. Refer to General Conditions for additional information regarding specific warranty requirements.

1.12. PROJECT RECORD DOCUMENTS

A. Before final payment, provide the Architect with one clean set of drawings and specifications corrected up-to-date as job progress. These documents shall reflect the As-Built conditions. Refer to General Conditions for additional information.

1.13. SUBMITTALS

A. The intent of this section is to give general submittal information, refer to specific submittal information in the subsequent electrical sections.

B. Within 10 days after award of the contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Minimum of six (6) copies, or as directed by the Engineer, of each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the specifications or in schedules on the drawings.

C. Requirements for each submittal:

1. Bear a dated stamp or specific written indication that the Contractor has reviewed and approved all submittal prior to submission to Engineer,
2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Engineer shall not extend to these areas unless specifically noted by Engineer),

3. **BE CLEARLY AND SPECIFICALLY** marked as to which specific piece of equipment is being submitted, bye use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
4. **BE CLEARLY AND SPECIFICALLY** marked as to which available options are being submitted that are associated with a piece of equipment, and
5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable the Engineer to review the proposed equipment.
6. **BE CLEARLY AND SPECIFICALLY** marked as to any and all submittal deviations from the design specification requirements shall be provided in written form.
7. Omission by Contractor of any of the above requirements or submittals will subject submittal to automatic rejection without review.
8. Any submittals received by Engineer that were not requested shall be returned without review of any kind.

D. Installation Instructions - For certain products or systems as identified in subsequent specifications sections or on the drawings, the Contractor shall be required to provide copies of manufacturer's installation instructions with the submittal. When required as such, the installation instructions are considered part of the submittal and their omission may result in automatic rejection of the submittal. Where more than one identical device are scheduled, only one set of installation instructions needs to be submitted, e.g. if seven 200A panels are scheduled; only electrical panel installation instruction needs to be submitted. Similarly, if one set of installation instructions is identified by the manufacturer and on the instructions to be applicable to more than one type or size of devices, e.g. if one set of panel instructions is good for 100A, 150A,200A, electrical panels, then only one instruction set is required for these devices.

E. This Engineer will review the submittals for approval twice. Any additional reviews that are required by the engineer for whatever reason after the initial two reviews will result in additional compensation for the Engineer's time by the submitting Contractor at the Engineer's rate.

1.14. PRIOR APPROVAL OF SUBSTITUTED PRODUCTS

A. Material or equipment specified by Manufacturer's name and model number is being used as a basis of standard and performance. No substitution is allowable without Engineer's written approval **FOURTEEN (14) DAYS PRIOR TO BID DUE DATE** unless the manufacturer is listed on the drawings or in the specification as being a preapproved alternative manufacturer.

B. A prior approval submittal package shall at a minimum consist of the following items:

1. One copy of the product submittal in accordance with the paragraph in this section titled SUBMITTALS.
2. Plan layouts sketches of mechanical rooms or systems of the substituted equipment showing that the proposed equipment will fit within the space allocated with the manufacturers and code required clearances for the substituted equipment as well as the other equipment in the space.
3. Indications of any structural modifications required for the proposed substitution, such as additional weight or opening size changes.
4. Indications of any electrical modifications required for the proposed substitution, such as changes in breaker sizes, wiring requirements.
5. Indication of any deviations from the specified equipment or their performance.

C. It shall be the Manufacturer and/or their authorized Representative's responsibility to verify that submitted substitute equipment will fit in space available. The Manufacturer and/or their authorized Representative's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but complete.

D. The Manufacturer and/or their authorized Representative's shall be responsible for the costs of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect of any and all other trades.

1.15. SUBSTITUTED PRODUCTS

A. Material or equipment specified by Manufacturer's name is being used as a basis of standard. No substitution is allowable without Engineer's written approval **FOURTEEN (14)** days prior to bid due date unless the manufacturer is listed on the drawings or in the specification as being a preapproved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.

B. It shall be the Contractor's responsibility to verify that submitted substitute equipment will fit in space available. The contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but complete.

C. The Contractor shall be responsible for the costs of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect of any and all other trades.

D. The Engineer may request detailed shop drawing or plan layouts of mechanical rooms or systems of the substituted equipment.

E. Should a substitution be approved by the Engineer (based upon the substitution submittal) and accepted, and should the substitute material or equipment prove defective, not meeting design parameters, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

1.16. SAFETY

A. General – Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

B. According to OSHA, a hazardous chemical is any chemical, which is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a contractor produces, uses, or stores hazardous chemicals at the workplace, them contractor shall develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. In projects with multiple tenants in which the building is partially occupied during all or part of the project, Contractor shall inform the building manager or Owner, according to OSHA guidelines, of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified. Contractor shall employ required methods of training, information, handling, ventilation, labeling, storing, disposal, and removal of hazardous chemicals.

1.17. LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Refer to General Conditions for list of such independent testing authorities.

1.18. SITE VISIT REPORTS

A. During the course of the job, the Engineer will make site visits to observe work in progress and will subsequently prepare a written site visit report, which will be sent to the Contractor and to whomever else the Engineer desires. The Contractor shall prepare a written and typed response within seven (7) calendar days of his receiving the site visit report. The General Contractor shall include in his response the following information.

1. Date of site visit by the Engineer,
2. Date of receipt of the site visit report,
3. Name and title of the preparer of the response,
4. An item number referenced to the site report,
5. A brief three or four word description of the item,
6. The Contractor or Subcontractor affected,
7. The proposed course of action, and
8. An expected time of completion of the action.

1.19. CUTTING AND PATCHING

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer and Architect.

B. Where it is necessary to cut through any non-structural elements of walls, floors, or ceilings to permit the installation of any work under this contract, or to repair any defects that may appear up to expiration of the guarantee, such cutting shall be done by the Contractor with as little damage as reasonably possible to the element being cut or to adjacent elements.

C. After the necessary work has been completed, the damage shall be repaired by the respective Contractor, who shall pay all costs of such cutting, repairs and patching. All patching or sealing of cuts and penetrations, including final appearance of same, shall be done to the approval of the Engineer and Architect.

1.20. INSURANCE

A. The Contractor shall have required insurance. Required insurance shall be provided by this Contractor for protection against public liability and property damage for the duration of work.

1.21. CONFLICTS AND CORRECTION OF WORK

A. Promptly correct work rejected or failing to conform to the requirements of the Contract, whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear cost of correcting such rejected and nonconforming work including additional testing and inspections and including compensation for observing mechanical and electrical engineering firm's services and expenses made necessary thereby.

B. If a conflict occurs on the bid documents, the Contractor shall contact the Architect's and Engineer's offices with a written request for clarification. If the conflict is un-resolvable at the time of bid, the most expensive interpretation of the conflict shall be bid so the conflict can be resolved in a deductive manner at a later time if necessary.

C. If a conflict is discovered during construction, the Contractor shall stop work and that portion of the project and contact the appropriate party for clarification. The request for clarification shall be in written form. The Contractor shall bare the burden of replacing work that has been installed incorrectly as a result of a conflict on the drawings where he has not sought the Architect's and/or Engineer's guidance for clarification.

1.22. COMMISSIONING

A. Coordinate all work with the commissioning agent and the commissioning specifications.

1.23. COORDINATION

A. In a timely manner, and coordinated with all work involved, prepare and submit a trade composite work plan to be integrated into the Commissioning Plan for the following areas:

1. Where new work of three or more trades or subcontractors is installed.
2. Where lead times are critical to the project schedule.
3. Provide construction grade drawing as needed to acquire approval of work plan.
4. Access or service spaces required for Electrical equipment.

B. Provide final coordination plan to be integrated into the Commissioning Plan to account for:

1. Matching the work to the final selection of equipment; incorporating manufacturer's published instructions into the design;
2. Changes in equipment arrangement, and associated changes in equipment piping, ducting, and electrical work different from what is shown or specified;
3. Changes by manufacturer between date of design and date of delivery of equipment;
4. Relocations resulting from more than one trade being shown or specified in these drawings and specifications in the same location;
5. Addition of minor structural, mechanical, and electrical work for a complete system;
6. And similar circumstances as described above;
7. Work shall not be installed prior to written reply acknowledging that coordination drawing submittals have accomplished the specified intent of coordination. Relocations of work installed prior to coordination drawing acknowledgment, if subsequently required to avoid interference, shall be made.

PART 2 – PRODUCTS

2.1. MATERIALS AND EQUIPMENT:

A. General: Refer to Division 1 sections for general requirements on products, materials and equipment. The following provisions expand or modify the requirements as applicable to electrical work:

B. Materials List: Within 15 days after award of contract, the Electrical Subcontractor shall submit to the Engineer a list, seven (7) copies, of all equipment, fixtures, materials, etc. to be furnished. Where such equipment will be furnished "as specified", a listing of the specific equipment manufacturer to be used on this project is sufficient. Where substitutions are proposed, complete data must be furnished showing performance, quality and dimensions. Written approval of the Engineer must be obtained before purchasing any substitute equipment.

C. All materials shall be new and shall bear the label of the Underwriter's Laboratories, Inc., or be listed under reexamination service. All materials shall be of the best grade and latest pattern of manufacturer as specified.

D. All work shall be performed in a neat, workmanlike manner and shall present a neat electrical appearance when completed.

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

F. 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 Engineer.

G. 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.

H. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

I. Compatibility: Provide products, which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work.

J. Substitution: Manufacturer's catalog numbers are specified for the purpose of establishing a standard. All proposed substitutions on specific materials (lighting fixtures but not limited to) shall be submitted in duplicate ten (10) days prior to bid openings. This request shall be accompanied by complete descriptions of the substitutes offered, including catalog cut sheets, performance, quality and dimensions. The entire burden of proof of equality shall be placed on the Electrical Subcontractor and the decision of the Engineer shall be final. All other electrical equipment, devices, etc. may have substitutions only if equal in quality and function to, or better than, the specified item. Complete descriptive and technical data shall be submitted on all proposed substitute items, together with the same data on the specified items. Material samples of the proposed substitute item, together with samples of the specified items, shall be submitted for comparison and test when requested by the Engineer.

K. Work Quality: 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 Electrical Subcontractor shall check all areas and surfaces where electrical equipment material is to be installed, removed or relocated and report any unsatisfactory conditions to the Engineer before starting work. Commencement of work signifies this Electrical Subcontractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of the workmen.

2.2. ELECTRICAL EQUIPMENT AND WIRING FOR ARCHITECTURAL AND MECHANICAL DIVISION:

A. Responsibility

1. Unless otherwise indicated, all motors, conduit, wiring, and controls (including temperature) shall be furnished, set in place, and wired in accordance with the following schedule. (MD is Mechanical Division AD is Architectural Division, and ED is Electrical Division)

MECHANICAL-ELECTRICAL ARCHITECTURAL COORDINATION
TABLE 1

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	WIRED AND CONNECTED UNDER
1. Equipment Motors and Thermal Overloads	MD	MD	ED

2. Motor Controllers(HOA): magnetic starters, reduced voltage starters and overload relays	MD (1)	ED (1)	ED
3. Disconnect switches, fused or unfused, HP rated switches, variable frequency drive controllers(HOA), thermal overload switches and fuses, manual operating switches	ED (1)	ED (1)	ED
4. Pushbutton stations(HOA), pilot lights, multi-speed switches, variable speed switches, float switches, thermostats, control relays, time clocks, control transformer, control panels, motor valves, damper motors, solenoid valves, EP and PE switches and interlocks	MD	MD (2)	MD (2)
5. Contactors, 120V control circuit outlets for control panels and for boiler controls and fire protection control and fire/smoke detectors	ED	ED	ED
6. Fire Sprinkler System Control – Supervisory Panels and devices, including tamper switches and flow switches	MD	MD(3)	ED
7. Plumbing Fixture Electrical Power: electric or gas water heaters, instantaneous water heater, electronic sensor systems, and circulation pumps	MD	ED(1 & 3)	ED(3)
8. Architectural Equipment as listed in Divisions 2 through 14 such as elevator, ADA door openers, projections screen, etc	AD (5)	MD (4 & 5)	ED (4 & 5)
9. Hospital and Medical Equipment: alarm stations, panel, manifolds	MD	MD	ED(3)
10. Kitchen Equipment	AD (5)	MD (4 & 5)	ED (4 & 5)
11. Fire and Smoke Duct Detectors	ED	MD	ED (3)

Notes:

1. If furnished as part of factory wired equipment, wiring, conduit, and connection only by ED
2. If float switches, line voltage thermostats, PE switches, time switches etc., carry the FULL LOAD CURRENT of any motor, they shall be furnished by the Mechanical Division, but shall be set in place, wired and connected by the Electrical Division, except that where such items are and integral part of the mechanical equipment, or directly attached to ducts, piping, etc., they shall be set in place under the Mechanical Division and wired and connected by the Electrical Division. If they do not carry the FULL LOAD CURRENT to any motor they shall be furnished, set in place and wired under the Mechanical Division.
3. Wiring and conduit from alarm contacts to alarm system and conduit for control functions by ED; all control function wiring by MD.
4. Wiring and conduit from alarm contacts and kitchen equipment shutdown to kitchen fire suppression system by ED; all control functions by MD.
5. Architectural division to set in place, Mechanical Contractor to make mechanical connections and Electrical Contractor to make electrical connections.

B. Connections

1. Connection to all control directly attached to ducts, piping and mechanical equipment shall be made with flexible connections not to exceed 3 linear feet.

2.3. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

PART 3 – EXECUTION

3.1. GENERAL REQUIREMENTS:

A. Comply with manufacturer's recommended installation procedures for electrical equipment. Refer to specific Division 26 specification sections for specific equipment installation requirements.

3.2. ELECTRICAL INSTALLATION

A. Install all work to permit removal (without damage to other parts) of breakers and all other parts, which might require periodic replacement or maintenance. Arrange conduit and equipment to permit ready access to panels and to clear opens of doors and of access panels.

B. Electrical Contractor shall coordinate with other trade with regards to equipment going under mechanical equipment.

C. Electrical Contractor shall install electrical equipment in a manner to provide the manufacturer's recommended service clearance and access space. The Electrical Contractor shall be responsible for maintaining these clearances, coordinating them with the other trades and have installed work modified to maintain these clearances at no additional charge to the project or the Owner.

3.3. PROTECTION OF PENETRATION

A. All penetrations of fire or smoke barriers shall be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code.

B. Contractor shall verify locations and type of all partitions penetrations from the drawings. Sealing material and methods shall be per UL recommendations. The Contractor shall fire stop all penetrations through fire and smoke rated barriers as required by code. Refer to Division 7 for fire stopping material information.

3.4. ELECTRICAL WORK CLOSEOUT:

A. General: Refer to the Division 1 sections for general closeout requirements. Upon completion of the work, the various systems operated under load conditions shall be tested for short circuits and grounds in accordance with the method and resistance values outlined in the National Electrical Code and for load balance on feeders and branch circuits.

B. The complete system shall operate satisfactorily in every respect. Make any repairs or adjustments necessary to this end to the satisfaction of the Engineer.

C. Furnish all instruments and labor for testing.

3.5. GUARANTEE:

A. The work to be performed shall be guaranteed for a period of one year after final acceptance against faulty workmanship and/or materials, and any failure or trouble due to such causes within the period of guarantee shall be made good upon demand of the Owner and without cost to the Owner.

3.6. MISCELLANEOUS ITEMS:

A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed and connected by the proper method and as recommended by the manufacturer.

B. Coordinate the thickness of the wall to accommodate the concealed conduits and its associated hangers, if required. I.E. 4-inch conduit requires a 6-inch thick wall.

3.7. 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. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no extra cost to him.

3.8. AS-BUILT DRAWINGS:

A. During progress of the Work, maintain an accurate record of the installation of the system. Upon completion of the installation, transfer all record data to blue line prints of the original drawings and furnish to the Engineer.

END OF SECTION 26 05 00

SECTION 26 05 01 – BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.2. WORK SEQUENCE

A. Install work to accommodate Owner's occupancy requirements during the construction period. Coordinate electrical schedule and operations with owner and engineer.

1.3. ALLOWANCES

A. Cash Allowance: Refer to Section 01 12 13 for allowance sum applicable to Work.

1.4. ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work as required.

1.5. REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. National Electric Safety Code

1.6. SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in single submittals.

C. Mark dimensions and values in units to match those specified.

1.7. REGULATORY REQUIREMENTS

A. Electrical: Conform to NFPA 70 and National Electrical Safety Code.

B. Obtain permits, and request inspections from authority having jurisdiction.

1.8. PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.9. SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Section 01010.

PART 2 – PRODUCTS

2.1. Not Used

PART 3 – EXECUTION

3.1. Not Used

END OF SECTION 26 05 01

SECTION 26 05 11 – MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Electrical demolition.

1.2. RELATED SECTIONS

A. Section 01 35 16 - Alteration Project Procedures.

B. Section 02 41 00 - Minor Demolition for Remodeling.

PART 2 – PRODUCTS

2.1. MATERIALS AND EQUIPMENT

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

PART 3 – EXECUTION

3.1. EXAMINATION

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

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

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

D. Beginning of demolition means installer accepts existing conditions.

3.2. PREPARATION

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

B. Coordinate utility service outages with Utility Company.

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

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner and Engineer at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3. DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Section 01 35 16, Section 02 41 00, and this Section.

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

C. Remove abandoned wiring to source of supply.

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

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

F. Disconnect and remove abandoned panelboards and distribution equipment.

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

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

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

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

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4. CLEANING AND REPAIR

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

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

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

3.5. INSTALLATION

A. Install relocated materials and equipment under the provisions of Section 01 35 16.

END OF SECTION 26 05 11

SECTION 26 05 13 – MEDIUM VOLTAGE CABLE

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Medium voltage cable.

B. Cable terminations.

1.2. REFERENCES

A. ANSI/IEEE C2 - National Electrical Safety Code.

B. ANSI/NFPA 70 - National Electrical Code.

C. IEEE 48 - Test Procedures and Requirements for High- Voltage Alternating-Current Cable Terminations.

D. NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

F. NEMA WC 7 - Cross-Linked-Thermosetting-Polyethylene- Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

G. NEMA WC 8 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.3. SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Provide for cable, terminations, and accessories.

C. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4. PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 70 00.

B. Accurately record actual sizes and locations of cables.

1.5. OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01 70 00.

B. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

1.6. QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in installing Products specified in this Section with minimum three years' experience.

1.7. REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01 50 00.

B. Accept cable and accessories on site in manufacturer's packaging. Inspect for damage.

C. Store and protect in accordance with manufacturer's instructions.

D. Protect from weather. Provide adequate ventilation to prevent condensation.

1.9. PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of cable bank prior to rough-in.

C. Cable routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 – PRODUCTS

2.1. MANUFACTURERS

A. Prysmian Model QN4030A.

B. Substitutions: With approval of engineer.

2.2. MEDIUM VOLTAGE CABLE

A. Single conductor cable with solid or stranded aluminum or copper conductors, triple extruded insulation system consisting of a thermosetting semiconducting conductor shield, high dielectric strength EPROTENAX™ EPR insulation, thermosetting semiconducting insulation shield, copper concentric neutral wires, water swellable agents, black encapsulating linear low-density polyethylene (LLDPE) jacket.

B. Voltage: 15 kV, grounded.

C. Conductor: Copper concentric, stranded, with conductor shield.

2.3. CABLE TERMINATIONS

A. Manufacturers:

1. Cooper Model LE215AB04TCS2.
2. Substitutions: With approval of engineer.

2.4. SEALING

A. Manufacturers:

1. 3M Model 8452.
2. Substitutions: With approval of engineer.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Verify installation conditions under provisions of Section 02 21 00.

B. Verify that conduit and trench is ready to receive cable.

3.2. PREPARATION

A. Use swab to clean conduits before pulling cables.

3.3. INSTALLATION

A. Install cable and accessories in accordance with manufacturer's instructions.

B. Avoid abrasion and other damage to cables during installation.

C. Use suitable lubricants and pulling equipment.

D. Do not exceed cable pulling tensions and bending radius.

E. Ground cable shield at each termination and splice.

F. Install cables in manholes along wall providing longest route.

G. Arrange cable in manholes to avoid interference with duct entrances.

H. Fireproof cables in manholes using fireproofing tape in half-lapped wrapping. Extend fireproofing one inch (25 mm) into duct.

3.4. FIELD QUALITY CONTROL

A. Inspect exposed cable sections for physical damage.

B. Inspect cable for proper connections as shown on Drawings.

C. Inspect shield grounding, cable supports, and terminations for proper installation.

D. Perform DC high potential test of each conductor in accordance with NEMA WC 5.

E. Connect untested conductors in circuit to ground during test.

F. Apply test voltage in at least eight equal increments to maximum test voltage.

G. Record leakage current at each increment, allowing for charging current decay.

H. Hold maximum test voltage for ten minutes.

3.5. PROTECTION

A. Protect installed cables from entrance of moisture.

END OF SECTION 26 05 13

SECTION 26 05 19 – BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes building wire and cable and wiring connectors and connections.

1.2. REFERENCES

A. NECA (National Electrical Contractors Association) – Standard of Installation.

B. NETA ATS (International Electrical Testing Association) – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3. WIRING METHODS AND PRODUCTS REQUIREMENTS

A. Product Requirements: Use products as indicated and as follows:

1. Use solid conductor for feeders and branch circuits 12 AWG and smaller.
2. Use conductor not smaller than 12 AWG for power and lighting circuits.
3. Use conductors for 80% of branch circuits circuit breaker size to provide no more than 3% voltage drop on branch circuits and no more than 5% voltage drop total from service entrance point to the load.

B. Wiring Methods: Use wiring methods indicated and as follows:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN, insulation in raceway.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation in raceway.
3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation in raceway.

1.4. FIELD MEASUREMENTS

A. Verify field measurements are as indicated

1.5. COORDINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

PART 2 – PRODUCTS

2.1. BUILDING WIRE

A. Manufacturers:

1. Houston Wire and Cable
2. Southwire
3. Substitutions: With approval.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation Voltage Rating: 600 volts.

E. Insulation: Thermoplastic material rated 75 degrees C.

2.2. WIRING CONNECTORS

A. Split Bolt Connectors:

1. Ilsco
2. Substitutions: Section 01 60 00 – Product Requirements – Permitted.

B. Solderless Pressure Connectors:

1. Ilsco
2. Substitutions: Section 01 60 00 – Product Requirements – Permitted.

C. Spring Wire Connectors:

1. Ilsco
2. Substitutions: Section 01 60 00 – Product Requirements – Permitted.

D. Compression Connectors:

1. Ilsco
2. Substitutions: Section 01 60 00 – Product Requirements – Permitted.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2. EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes if wire and cable servicing them is abandoned and removed. Provide blank cover for abandoned boxes, which are not removed.

C. Ensure access to existing wiring connections which remain active and which require access. Modify installation or provide access panel as appropriate.

D. Extend existing circuits using materials and methods compatible with existing electrical installations or as specified.

3.3. INSTALLATION

A. Route wire and cable as required to meet Project conditions.

B. Install wire and cable in accordance with the NECA “Standard of Installation.”

C. Neatly train and lace wiring inside boxes, equipment and panelboards.

3.4. FIELD QUALITY CONTROL:

A. Section 01 40 00 – Quality Requirements: Testing and inspection services.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspection and tests listed in NEAT ATS, Section 7.3.1

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Equipment grounding conductors.

B. Bonding.

1.2. REFERENCES

A. Section 01 45 00 – Quality Control: Requirements for references and standards.

B. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

C. NFPA 70 – National Electrical Code.

1.3. REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

C. Conforms to requirements of NFPA 99.

PART 2 – PRODUCTS

2.1. EQUIPMENT GROUNDING CONDUCTOR

A. Material: Stranded copper.

B. Size to meet NFPA 70 requirements.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Section 01 31 00 – Coordination and Meetings: Verification of existing conditions prior to beginning work.

3.2. INSTALLATION

A. Section 01 45 00 – Quality Control: Manufacturer's instructions.

B. Provide bonding to meet Regulatory Requirements.

C. Bond together each metallic raceway, pipe, duct and other metal objects.

D. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3. FIELD QUALITY CONTROL

A. Section 01 43 00 – Quality Assurance: Field inspection, testing and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION 26 05 26

SECTION 26 05 29 – SUPPORTING DEVICES

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.2. REFERENCES

A. Section 01 45 00 – Quality Control: Requirements for references and standards.

B. NECA Standard of Installation (National Electrical Contractors Association).

C. NFPA 70 – National Electrical Code.

1.3. SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals: Procedures for submittals.

B. Product Data: Provide manufacturers catalog data for fastening systems.

1.4. REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 – PRODUCTS

2.1. PRODUCT REQUIREMENTS

A. Materials and Finishes: Corrosion resistant.

B. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use pre-cast inserts, expansion anchors and preset inserts.
2. Steel Structural Elements: Use beam clamps and welded fasteners.
3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
5. Solid Masonry Walls: Use expansion anchors.
6. Sheet Metal: Use sheet metal screws.

2.2. FORMED STEEL CHANNEL

A. Manufacturers:

1. B-line.
2. Unistrut.
3. Substitutions: Refer to Section 01 60 00 – Material and Equipment.

B. Description: Galvanized or Painted steel.

PART 3 – EXECUTION

3.1. INSTALLATION

A. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
2. Do not drill or cut structural members.

B. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 05 29

SECTION 26 05 33 – CONDUIT

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquid tight flexible metal conduit.

D. Electrical metallic tubing.

E. Nonmetal conduit.

F. Fittings and conduit bodies.

1.2. RELATED SECTIONS

A. Section 07 84 00 - Fire Stopping.

B. Section 26 05 43 - Underground Duct Bank.

C. Section 26 05 34 - Boxes.

D. Section 26 05 26 - Grounding and Bonding.

E. Section 26 05 29 - Supporting Devices.

F. Section 26 05 53 - Electrical Identification.

1.3. REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code.

E. NECA "Standard of Installation."

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4. DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.5. SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquid tight flexible metal conduit, metallic tubing, nonmetallic conduit and conduit bodies.

1.6. PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 78 39.

1.7. REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01 60 00.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.9. PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 – PRODUCTS

2.1. CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch unless otherwise specified.

B. Underground Installations:

1. More than Five Feet from Foundation Wall: use rigid steel conduit or plastic coated conduit
2. Within Five Feet from Foundation Wall: Use rigid steel conduit.
3. In or Under Slab on Grade: Use rigid steel conduit or plastic coated conduit.
4. Minimum Size: 3/4 inch.

C. Outdoor Locations, Above Grade: Use rigid steel conduit.

D. In Slab Above Grade:

1. Use rigid steel conduit or thick wall nonmetallic conduit.
2. Maximum Size Conduit in Slab: 1/2 inch.

E. Wet and Damp Locations: Use rigid steel conduit.

F. Dry Locations:

1. Concealed: Use rigid steel conduit and electrical metallic tubing.
2. Exposed: Use rigid steel conduit and electrical metallic tubing.

2.2. METAL CONDUIT

A. Manufacturers:

1. Allied.
2. Substitutions: Under provisions of Section 26 05 00.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.3. FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Alflex.
2. Greenfield.
3. Substitutions: Under provisions of Section 26 05 00.

B. Description: Interlocked steel construction.

C. Fittings: ANSI/NEMA FB 1.

2.4. LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Ultratight.
2. Substitutions: Under provisions of Section 01 60 00.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: ANSI/NEMA FB 1.

2.5. ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied.
2. Substitutions: Under provisions of Section 01 60 00.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel, compression type.

2.6. NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon.
2. Cantex.
3. Substitutions: Under provisions of Section 01 60 00.

B. Description: NEMA TC 2; Schedule 40 and 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 – EXECUTION

3.1. INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

G. Do not attach conduit to ceiling support wires.

H. Arrange conduit to maintain headroom and present neat appearance.

I. Route exposed conduit parallel and perpendicular to walls.

J. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

K. Route conduit in and under slab from point-to-point.

L. Do not cross conduits in slab.

M. Maintain adequate clearance between conduit and piping.

N. Maintain 12-inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

O. Cut conduit square using saw or pipe-cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch (50 mm) size.

T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

V. Provide suitable pull string in each empty conduit except sleeves and nipples.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Ground and bond conduit under provisions of Section 26 05 26.

3.2. INTERFACE WITH OTHER PRODUCTS:

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

END OF SECTION 26 05 33

SECTION 26 05 34 – BOXES

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.2. RELATED SECTIONS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 13 - Access Doors.

C. Section 26 27 26 - Wiring Devices: Wall plates in finished areas.

D. Section 26 27 16 - Cabinets and Enclosures.

1.3. REFERENCES

A. NECA – Standard of Installation.

B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA 70 – National Electrical Code.

1.4. SUBMITTALS FOR CLOSEOUT

A. Section 01 70 00 – Contract Closeout: Submittals for Project closeout.

B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5. REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 – PRODUCTS

2.1. OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2. PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Division 1.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.
2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "ELECTRIC".

PART 3 – EXECUTION

3.1. EXAMINATION

A. Verify locations of outlets in offices and work areas prior to rough-in.

3.2. INSTALLATION

A. Install boxes in accordance with NECA "Standard of Installation."

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.

E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

F. Maintain headroom and present neat mechanical appearance.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

I. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 27 00.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

K. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

M. Use flush mounting outlet box in finished areas.

N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

O. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.

P. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

Q. Use stamped steel bridges to fasten flush mounting outlet box between studs.

R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

S. Use adjustable steel channel fasteners for hung ceiling outlet box.

T. Do not fasten boxes to ceiling support wires.

U. Support boxes independently of conduit.

V. Use gang box where more than one device is mounted together. Do not use sectional box.

W. Use gang box with plaster ring for single device outlets.

X. Use cast outlet box in exterior locations exposed to the weather and wet locations.

Y. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

Z. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3. INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment connected under Division 1.

3.4. ADJUSTIN

A. Section 01 70 00 – Contract Closeout: Adjusting installed work.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.5. CLEANING

A. Section 01 70 00 – Contract Closeout: Cleaning installed work.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 34

SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.2. RELATED SECTIONS

A. Section 09 91 00 – Painting.

1.3. REFERENCES

A. Section 01 45 00 – Quality Control: Requirements for references and standards.

B. NFPA 70 – National Electrical Code.

1.4. SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals: Procedures for submittals.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

1.5. REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 – PRODUCTS

2.1. NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.

C. Letter Size:

1. 1/8-inch letters for identifying individual equipment and loads.
2. 1/4-inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background. Use only for identification of individual wall switches and receptacles and control device stations.

2.2. WIRE MARKERS

A. Manufacturers:

1. Brady
2. Panduit
3. Substitutions: Refer to Section 01 60 00 – Material and Equipment.

2.3. UNDERGROUND WARNING TAPE

A. Description: 4-inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.

B. Location: Along length of each underground conduit.

PART 3 – EXECUTION

3.1. PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2. INSTALLATION

A. Section 01 45 00 – Quality Control: Manufacturer's instructions.

B. Install nameplate and label parallel to equipment lines.

C. Secure nameplate to equipment front using rivets.

D. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

E. Identify underground conduits using one underground warning tape per trench at 3 inches (75 mm) below finished grade.

END OF SECTION 26 05 53

SECTION 26 13 19 – AIR INTERRUPTER SWITCHES

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Medium voltage interrupter switches.

1.2. REFERENCES

A. ANSI/IEEE 24 – Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.

B. ANSI/IEEE 37.20 – Switchgear Assemblies, Including Metal- Enclosed Bus.

C. IEEE 48 – Test Procedures and Requirements for High- Voltage AC Cable Terminations.

D. ANSI Z55.1 – Gray Finishes for Industrial Apparatus and Equipment.

1.3. SUBMITTALS

A. Submit shop drawings under the provisions of Section 01 30 00.

B. Submit shop drawings indicating outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, and equipment electrical ratings.

C. Submit product data under the provisions of Section 01 30 00.

D. Submit product data for components and accessories.

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

1.4. OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section [1 70 00.

B. Include fuse replacement, adjustment, and lubrication instructions.

1.5. QUALITY ASSURANCE

A. Manufacturer: Company specializing in medium voltage interrupter switches with three years experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 50 00.

B. Store and protect products under provisions of Section 01 50 00

C. Accept interrupter switches on site and inspect for damage.

D. Protect interrupter switches from weather and moisture by covering with heavy plastic or canvas and by maintaining heat within enclosure in accordance with manufacturer's instructions.

1.7. EXTRA MATERIALS

A. Submit maintenance materials under provisions of Section 01 70 00.

B. Submit two insulated-handle tools designed for pulling fuses.

C. Provide [wo sets of spare fuses of each size and rating under provisions of Section 01 70 00.

PART 2 – PRODUCTS

2.1. MANUFACTURERS

A. S&C

B. Substitutions: With approval.

2.2. AIR INTERRUPTER SWITCHES

A. Switches: ANSI/IEEE 37.20; switchgear assembly including individual air interrupter switches in free-standing cubicles[, securely bolted together to form an integrated structure.]

B. System Voltage: 13.6 kV, three phase, 60 Hz.

C. Maximum Design Voltage: 15 kV.

D. Main Bus Ampacity: 600 amperes, continuous.

E. Short Circuit Rating: 14000 rms symmetrical amperes; 350 rms symmetrical MVA at rated nominal voltage.

2.3. COMPONENTS

A. Interrupter Switch: Fused two position load interrupter switch.

B. Voltage and Short Circuit Ratings: Match ratings specified for integrated assembly.

2.4. FABRICATION

A. Construction: Weatherproof.

B. Provide separate access to fuses through main cabinet door.

C. Include continuous ground bus through switchgear assembly, securely connected to frame of each cubicle.

D. Make top and rear covers removable.

E. Main Bus: Copper.

F. Provide lugs for incoming feeder in cubicle.

2.5. MANUFACTURERS - MEDIUM VOLTAGE FUSES

A. Elastimold

B. Substitutions: With approval.

2.6. MEDIUM VOLTAGE FUSES

A. Fuse: Enclosed current limiting, suitable for use outdoors in enclosure.

B. Fuse Rating: [E] [R] rated fuse, size as indicated.

C. Voltage: 15 kV.

D. Interrupting Rating: 45 amperes rms symmetrical.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as shown on shop drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing surface conditions.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.3. FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Visually inspect for physical damage.

C. Perform mechanical operator tests in accordance with manufacturer's instructions. Check blade alignment and arc interrupter operations.

D. Verify key interlock operation.

E. Perform insulation resistance test on each phase to ground and from each phase to each other phase. Record results.

F. Perform AC or DC over-potential test to ANSI/IEEE 37.20.

G. Perform contact resistance test across each switch blade; report any contact resistance in excess of 50 microohms.

END OF SECTION 26 13 19

SECTION 26 22 13 – DISTRIBUTION TRANSFORMERS

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Pole mounted distribution transformers.

B. Liquid filled pad mounted distribution transformers.

C. Dry type pad mounted distribution transformers.

1.2. RELATED SECTIONS

A. Section 03 33 00 – Cast-In-Place Concrete: Pads for transformer support.

B. Section 26 26 00 – Overhead Power Distribution: Poles and cutouts.

1.3. REFERENCES

A. ANSI C37.47 – Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current- Limiting Fuses.

B. ANSI/IEEE C57.12.01 – General Requirements for Dry-Type Distribution and Power Transformers.

C. ANSI C57.12.20 – Requirements for Overhead Type Distribution Transformers, 500 kVA and Smaller: High- Voltage, 67000 Volts and Below; Low-Voltage, 15000 Volts and Below.

D. ANSI/IEEE C57.12.90 – Test Code for Liquid-Immersed Distribution Power and Regulating Transformers.

E. ANSI/IEEE C57.12.91 – Test Code for Dry-Type Distribution and Power Transformers.

F. ANSI/IEEE C57.13 – Requirements for Instrument Transformers.

G. ANSI/IEEE 386 – Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.

H. ASTM D877 – Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

I. NEMA AB1 – Molded Case Circuit Breakers.

J. NEMA 260 – Safety Labels for Pad mounted Switchgear and Transformers Sited in Public Areas.

1.4. SUBMITTALS

A. Submit shop drawings under the provisions of Section 01 30 00.

B. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.

C. Submit product data under the provisions of Section 01 30 00.

D. Submit product data indicating standard model design tests and options.

E. Submit manufacturer's installation instructions under provisions of Section 01 30 00.

1.5. OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

B. Include procedures for [sampling and maintaining fluid,] cleaning unit, and replacing components.

1.6. QUALITY ASSURANCE

A. Manufacturer: Company specializing in distribution transformers with three years documented experience.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 01.

B. Protect dry type transformers from moisture by using appropriate heaters as instructed by the manufacturer.

PART 2 – PRODUCTS

2.1. MANUFACTURERS – PAD MOUNTED TRANSFORMERS

A. Eaton

B. Schneider

C. Substitutions: With approval.

2.2. PAD MOUNTED TRANSFORMERS

A. Liquid-filled Transformers: ANSI C57.12.22; three phase, pad mounted, self-cooled transformer unit.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Verify that pads are ready to receive work.

B. Verify field measurements are as [instructed by manufacturer.

C. Verify that required utilities are available, in proper location and ready for use.

D. Beginning of installation means installer accepts conditions.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install safety labels to NEMA 260.

3.3. FIELD QUALITY CONTROL

A. Test dielectric liquid to ASTM D877, using 25,000 volts minimum breakdown voltage, after installation and before energizing from system.

B. Test transformer to ANSI/IEEE C57.12.90.

C. Test transformer to ANSI/IEEE C57.12.91.

3.4. ADJUSTING

A. Adjust work under provisions of Section 01 70 00.

B. Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

END OF SECTION 26 22 13

SECTION 31 05 00 - COMMON WORK RESULTS FOR EARTHWORK

PART 1 - GENERAL

1.1. SCOPE

A. This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable. Included are the following topics:

1.2. RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. 00 00 00 – (Section Title)
2. 00 00 00 – (Section Title)

1.3. REFERENCED ORGANIZATIONS

A. Applicable provisions of Division 1 shall govern all work under this section.

B. Abbreviations of organizations referenced in these specifications are as follows:

1. AASHTO American Association of State Highway and Transportation Officials
2. ACPA American Concrete Pipe Association
3. ANSI American National Standards Institute
4. ASCE American Society of Civil Engineers
5. ASME American Society of Mechanical Engineers
6. ASTM American Society for Testing and Materials
7. AWWA American Water Works Association
8. AWS American Welding Society
9. FHA Federal Highway Administration
10. EPA Environmental Protection Agency
11. NEC National Electric Code
12. NEMA National Electrical Manufacturers Association
13. NFPA National Fire Protection Association
14. NSF National Sanitation Foundation
15. OSHA Occupational Safety and Health Administration
16. STI Steel Tank Institute
17. UL Underwriters Laboratories Inc.

1.4. QUALITY ASSURANCE

A. Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

B. Provide quality assurance testing and reporting as required by individual specification sections.

1.5. SAFETY

A. Contractor is solely responsible for worksite safety.

B. Perform all work in accordance with applicable OSHA, state and local safety standards.

C. Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities and private utilities be located by the appropriate parties.

1.6. PERMITS

A. Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

1.7. CONSTRUCTION LIMITS

A. Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Construction Representative. In no case shall construction activities extend beyond state property lines or construction easements.

B. The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Construction Representative.

C. Coordinate work under this project with work by Owner and other contractors on the site.

1.8. SUBMITTALS

A. Refer also to Section GC - General Conditions of the Contract and Division 1.

B. Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

C. Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Construction Representative at the Pre-Construction Meeting.

1.9. OFF SITE STORAGE

A. Refer to Division 1.

B. In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Construction Representative, together with the execution of a Storage Agreement will be required.

1.10. CODES

A. Comply with the requirements of all applicable, local, state and federal codes.

1.11. CERTIFICATIONS AND INSPECTIONS

A. Refer to Section GC - General Conditions.

B. Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Construction Representative w/I 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

PART 2 - MATERIALS

2.1. BARRICADES, SIGNS, AND WARNING DEVICES

A. Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

2.2. TEMPORARY PLASTIC BARRIER FENCING

A. UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

B. Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts.

PART 3 - EXECUTION

3.1. MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS

A. Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Construction Representative.

3.2. CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL

A. Refer also to Section GR - General Requirements.

B. Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the Construction Representative. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from applicable municipalities.

C. When Contractor’s activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents or as shown on the Drawings.

3.3. PROTECTION AND CONTINUITY OF EXISTING UTILITIES

A. Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

B. Do not interrupt or change existing utilities without prior written approval from the DFD Construction Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor’s foreman or other contact.

C. Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

3.4. PROTECTION OF EXISTING WORK AND FACILITIES

A. Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Construction Representative immediately. Correct and pay for all damages.

END OF SECTION 31 05 00

SECTION 31 23 16 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete trenching for utilities and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITALS

A. Provide copies of record drawings.

B. Provide samples of each type of soil or aggregate proposed for use on the project. Samples shall consist of a minimum of 50 pounds of soil. The contractor shall be responsible for delivering soil samples to the testing agency as designated by the DFD Construction Representative. Provide samples a minimum of 2 weeks prior to starting construction.

C. Provide copies of material testing reports.

1.04 RECORD DRAWINGS

A. Maintain record drawings showing actual locations of utilities and other features encountered, modifications to proposed grades and site features, and other deviations from the original design.

1.05 QUALITY ASSURANCE

A. The Contractor shall complete quality assurance testing as outlined in Table 31 23 16.13-1:

Material	Test Required	Test/Sample Frequency
I.E. Granular Fill	*I.e. D2922-01 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods*	*I.e. 1 test/500 lf trench*

Table 31 23 16.13-1

1.06 PERMITS/FEES

A. Contractor shall be solely responsible for obtaining all permits necessary to complete trenching work. The Contractor shall pay all fees associated with obtaining permits. These include but are not limited to permits to work within right-of-way, utility connection permits, plumbing permits, electrical permits and other building permits.

1.07 SURVEY AND STAKING

A. Owner or A/E will provide benchmarks and control points for the project.

B. Contractor shall be responsible for transferring benchmarks, control points, lines and grades as necessary to complete his work.

PART 2 - MATERIALS

2.01 UTILITY BEDDING AND COVER

A. Class “B” stone chip bedding.
B. Use bedding free from clumps, rocks, organic and frozen materials.
C. Use crushed stone chips meeting the following for all direct buried utilities and utility tunnel:

Gradation Sieve Size	% passing (by weight)
1 inch	100
3/4 inch	90 to 100
1/2 inch	---
3/8 inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5
No. 100	---

Lifts not-to-exceed 18” see Table 31 23 16.13-2 for final compacted lift height
Each lift compacted to 90 percent of dry density in accordance with ASTM D1557

2.02 FREE DRAINING FILL

A. Comply with ASTM C33 grading requirements. Washed gravel or crushed stone, 1/4 inch minimum, 3/4 inch maximum.

2.03 EARTH BACKFILL

A. Sand/gravel non-cohesive non-expansive, free of vegetable matter, clay , rubbish, rock larger than 2 inches, boulders, concrete, paving, masonry debris, waste, frozen materials, other inorganic and deleterious materials. Existing material meeting these requirements can be reused.

2.04 CONTROLLED BACKFILL

A. Sand or pit-run sand/gravel, meeting the following above all direct buried utility and utility tunnel:

Gradation Sieve Size	% passing (by weight)
2-1/2 inch	100
1 inch	90 to 100
3/4 inch	70 to 100
No. 4	60 to 100
No. 200	15 or less

2.05 FLOWABLE FILL

A. Controlled low strength material (CLSM) or flowable slurry fill.
B. Cement: Any Type, 100 lb./cu. yd & 50 lb. per cu. yd.
C. Aggregate: None required for slurry fill, sand for utility support.
D. Strength: 50 – 100 + psi @ 28 days.
E. Slurry: As necessary.
F. Fly Ash: Any class in quantity equal to cement.
G. Thoroughly mix in a clean ready mix truck; run mixer at mixing speed for one minute just prior to placement to insure an even mixture.

2.06 CRUSHED STONE BEDDING

A. Clean material meeting the requirements of "¾" Crushed Stone Chips" as defined in Section 6.43.2(a)2, regardless of pipe size, of Standard Specifications for Sewer and Water Construction.

2.07 CRUSHED STONE SCREENINGS

A. Crushed stone free of organic material, concrete, asphalt and other debris. Material shall meet the requirements of "Crushed Stone Screenings" as defined in Section 6.43.2(b) of Standard Specifications for Sewer and Water Construction.

2.08 BEDDING SAND

A. Sand meeting the requirements of "Bedding Sand" as defined in Section 6.43.2(c) of Standard Specifications for Sewer and Water Construction.

2.09 CEMENT SLURRY GROUT

A. Portland cement based grout having a slump of 10”-12” and the following mix proportion (per CY):

Type 1 Portland Cement	100#
Class C Fly Ash	300#
Fine Aggregate	2700#
Water	400#
Air Entraining Admixture	35 oz

2.10 Similar mix designs that are suitable for the intended use will be considered.

PART 3 - EXECUTION

3.01 PREPARATION

A. General Contractor shall excavate and backfill the following utilities in accordance with this section:

B. Steam box conduits, sump & dewatering discharge piping, and pits.

C. Underground chilled water pipe

D. Underground primary/signal vaults and ductbanks

E. Storm and sanitary piping.

F. Direct buried power and signal conduits.

G. Remove excavated materials throughout day.

H. No stockpiling of excavated materials on site.

I. Review plans and prepare work plan and schedule. Coordinate any necessary interruptions in utility service with DFD Construction Representative, in accordance with other specification sections.

J. Layout work. Establish and transfer line and grade as necessary to complete the work.

K. Remove topsoil from work area. Saw cut and remove pavement from the work area.

3.02 UNDERGROUND LOCATES

A. Contractor shall include ALL underground utility locates. Locates shall include excavation, backfill, survey and pictures of existing utilities within the construction limits. Survey information shall include size, elevation, GPS location, materials and height and width of utility. Locates shall be authorized by DFD Representative.

3.03 CONNECTIONS TO EXISTING UTILITIES

A. Connect to existing utilities in accordance with the requirements of other pertinent specification sections.

3.04 EXCAVATION

A. Excavate to elevations and dimensions necessary to complete construction. Excavations shall be sufficiently deep to provide for bedding beneath pipes and structures, to provide steam tunnel water proofing and as otherwise required to complete the work as shown.

B. For pipes less than 12” in diameter, maximum trench width at the top of the pipe shall be 3’. For pipes greater than 12” in diameter, the maximum trench width at the top of the pipe shall be no greater than the outside diameter of the pipe plus 2’.

C. The trench width at the ground surface shall be minimized to the extent possible through the use of trench boxes, shields, or shoring, and as necessary to protect features and improvements that are shown to be protected on the drawings.

D. The trench width at the ground surface shall not exceed the width of the trench at the top of the pipe by more than 2’ without prior approval by the DFD Construction Representative.

E. Provide a minimum clearance of 6” from outside of pipe to the closest of either the sidewall of trench or inside wall of trench box, shield or shoring.

F. Notify DFD Construction Representative if trench subgrade consists of unstable soil, organic material, debris or other undesirable material.

G. Segregate the various materials excavated. Reserve material meeting the requirements of backfill for the location. Excavated material that does not meet the requirements of backfill, and excess excavated material, shall be removed from the site and disposed by the contractor, unless directed otherwise by other specification sections or the DFD Construction Representative.

H. Locate bedding, backfill and spoil piles in accordance with OSHA requirements, and so that it does not interfere with public travel, adjacent landowners or other construction activities.

I. Trench excavation shall be limited to that which can be excavated and backfilled within the same workday.

J. The same trench may obstruct no more than one street crossing at one time.

K. Where a new or existing utility pipeline, structure, box conduit or signal/power conduit requires support, or where existing utility lines are required to be abandoned in place, provide one of the flowable fill materials approved by the engineer and/or construction representative.

L. Provide a dewatering sump with pump and emergency generator power in each excavation from the first day of excavation until the excavation is backfilled. Provide a sump with a pump and emergency generator power in each tunnel, new and existing steam pits from the first day of excavation until the excavation is backfilled and the permanent sump pumps are installed.

M. The same trench may not obstruct more than one street crossing at one time.

N. Do not interfere with 45 degree bearing splay of foundations.

O. Elevations for contours as shown on the plans, are subject to such revisions as may be necessary to fit field conditions and that the Owner's Project Representative reserves the right to adjust grades from those shown on the plans to fit field conditions.

P. Unless otherwise provided in contract or permitted by the Engineer, the work of constructing sewers and allied works shall be done in open trenches and in a manner to protect the pipe lines or sewers from unusual stresses. When provided in the contract or permitted by the Engineer, the construction of sewers may be done by tunneling and/or jacking in lieu of open trenching; details of construction shall be indicated on the plan, specified in the contract, or established by the Engineer prior to beginning the work of tunneling and/or jacking. All of the work of construction sewers shall be done in accordance with the applicable provisions of the “Wisconsin Administrative Code”, applicable standards or requirements of the local authority having jurisdiction.

Q. The trenches shall be excavated in conformity with the required alignment and grades as shown on the plans and as laid out in the field by the Engineer. It shall be understood that the elevations for sewers, as shown on the plans, are subject to such revisions as may be necessary to fit field conditions and that the Engineer reserves the right to adjust the profile grades from those shown on the plan. No adjustment in compensation will be made for the grade adjustments not in excess of 1-foot above or below the elevations shown on the plans.

R. Unless noted on the drawings, the Contractor shall remove all vegetation along the trench line to the width of the proposed trench before beginning excavation. Vegetation removed shall not be used as backfill in the trench but shall be disposed of by the Contractor at no additional cost to the OWNER OR DFD. If the trench line is finished with pavement or other structures, removal of those items shall be incidental to the trench excavation.

S. The width of the utility trench shall be such as to leave a clear space of not less than 6 inches nor more than 12 inches between the earth wall, or the supporting sheeting or bracing where such is used, and the sides of the utility. The trench width established by this utility clearance, measured at the spring line, shall be applicable to that portion of the trench from 1-foot above the top of the utility to the bottom of the trench. On streets opened to traffic, on restricted easements, and in such other locations as the Engineer directs, the width of the trench at the surface of the ground shall be limited to the outside dimension of the utility plus 2 feet plus the amount necessary for sheeting or bracing.

T. Surplus material shall be considered to include vegetation from the trench line, excavated rock or boulders larger than 6 inches in diameter, and all other material from excavation not needed or suitable for backfilling trenches. Unless otherwise specified, surplus material shall be the property of the Contractor, and shall be disposed of at Contractor's cost.

U. Unless otherwise provided, the Contractor shall provide all trench soil retention, sheeting and/or bracing needed to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. Such trench soil retention, sheeting and/or bracing shall be according to the Contractor's design and shall comply with the "Wisconsin Administrative Code".

V. Removal of any trench soil retention, sheeting and/or bracing from the trench shall be accomplished in such a manner as to fulfill the above requirements. Sheeting and bracing shall be removed unless specific permission is given by DFD to leave it in place.

W. The DFD reserves the right to limit the extent of excavation in advance of utility installation and backfilling depending on the nature of the soil and other conditions affecting the work.

X. The DFD reserves the right to order additional excavation where unsuitable soil conditions exist to install utilities. When this condition arises, the excavation shall be carried to such depth as directed by the Engineer. The maximum width of the extra trench excavation shall be the outside of the proposed structure plus 2 feet plus the amount necessary for trench soil retention, sheeting and/or bracing. Undercut backfill shall be installed and mechanically compacted to replace the excavated materials to subbase grade.

Y. Work necessary to expose existing underground facilities that are part of the Contractor's statutory obligation during the normal storm sewer, sanitary sewer, chilled water, steam, condensate and compressed air utilities, electrical conduit or water main installation shall be considered as incidental to those respective items.

3.05 SUPPORT OF EXISTING UTILTIES

A. Contractor shall support all conduits, sewers, structures, piping, wiring and cables that are exposed due to trenching and excavations. Support system shall be designed by an engineer licensed in the State of Wisconsin.

B. Provide by-pass pumps, piping and structures needed to keep the existing service on line while allowing work to progress.

C. Provide all temporary piping as needed. Existing storm and sanitary sewer piping may have joints that leak.

D. Provide temporary joint wraps and clamps to keep storm and sanitary sewer piping from leaking into excavation or provide temporary storm and sanitary sewer piping to keep excavation dry and clean.

E. All open cut excavations shall have 6mil plastic sheeting installed to cover and protect slope of excavation.

3.06 INSULATION FOR EXISTING UTILITIES

A. Contractor shall provide temporary insulation over exposed utilities to keep them from freezing.

3.07 BEDDING AND UTILITY COVER

A. If unstable native soils are adjacent to bedding and utility cover in trench wrap bedding and utility cover in geotextile fabric. Where sheet piling/shoring is abandoned between unstable soil and trench wall geotextile fabric may be omitted.

B. Bed pipes and place utility cover material in accordance with detail drawings and the requirements of specifications for the utility and pipe type being installed (minimum 6” depth of bedding).

C. Establish excavation subgrade in accordance with proposed utility lines and grades, allowing for required amount of bedding material.

D. Excavation shall be reasonably free of water prior to placement of bedding material.

E. Place bedding material to required depth, and compact as specified in table 31 23 16.13-2.

F. Shape bedding material to conform to bell of pipe, fittings and structures.

G. After placing pipe, support during placement and compaction of initial utility cover material. Place utility cover to required depth and compact to 12” above utility piping, as specified in table 31 23 16.13-2.

H. Compaction of initial cover material for pipe and fittings shall be accomplished using hand tools and vibratory plate or tamping type walk behind compactors.

3.08 BACKFILL AND COMPACTION

A. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris.

B. Backfill trenches from elevations 12” above utility cover material to subgrade below pavements, base course, and topsoil as required by the plans and other Contract Documents. Where final restoration will be delayed, backfill trench to existing grade to provide a safe, free-draining surface. Ramp around structures left above surface.

C. Moisture condition backfill material as necessary to achieve density required for given use.

D. Do not place material on frozen surfaces or use frozen material.

E. Compact material to minimize settlement and avoid damage to structures, pipes, utility lines and other features. Place backfill simultaneously on both sides of structures.

F. It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified density. Vibratory plate or tamping type walk behind compactors will be required whenever backfill is placed adjacent to structures, pipes, utility lines and other features.

G. Flooding or jetting of backfill material for compaction purposes is not allowed.

Location	Required Material	Maximum Compacted Lift Thickness	Minimum Proctor Compaction	Minimum Relative Density [(a)]
Bedding Materials Beneath Footings, Slabs, or Structures	Controlled Backfill	12”	95% Modified	70%
Bedding Materials Beneath Utilities	Utility Bedding and Cover	12”	95% Modified	70%
Utility Cover – Areas Over Bedding Materials to 12” Over Utilities	Utility Bedding and Cover	12”	95% Modified	70%
Areas Between Top Soil and Utility Cover	Earth Backfill	12”	90% Modified	50%
Areas Between Utility Cover and Crushed Aggregate Basecourse Beneath Existing or Proposed Pavement (Roads, Drives, Walks)	Controlled Backfill	12”	95% Modified	60%
Areas with 10’ of an Existing or Proposed Building or Structure Footing or Slab	Controlled Backfill	12”	95% Modified	60%
Turf Areas	Earth Backfill	12”	88 % Modified	50%

Minimum relative density as determined by ASTM D-4253-00 for coarse-grained soils with less than 15% by mass passing the No. 200 sieve. Applicable only when minimum proctor compaction cannot be achieved.

Table 31 23 16.13-2

3.09 FLOWABLE FILL

A. Where a new or existing utility pipeline, structure, box conduit or signal/power conduit requires support, or where existing utility lines are required to be abandoned in place, provide one of the flowable fill materials approved by the engineer and/or construction representative.

3.10 GRADING

A. Grading shall include areas necessary to establish new grades as required, additional areas disturbed by construction activities, storage, equipment including all trenching, where excess fill is deposited and where cutting is required.

B. New grades are designed to produce desired configuration of site and do not represent a balance between cut and fill.

C. Excavated materials shall be disposed of by contractor at a suitable off-site location. Contractor shall be responsible for securing suitable disposal site(s) and for all off site disposal costs.

D. Place grade stakes at not more than 25 foot intervals both ways. Grades not indicated shall be uniform levels or slopes between point elevations as shown. Adjust all grades as necessary to provide positive drainage away from structures.

E. Contractor may utilize GPS controlled grading equipment. Contractor shall be responsible for Owner’s cost to provide design files and for the accuracy of the files used.

F. Grades for earthwork shall not deviate from established elevations, as shown in excess of 1 inch unless otherwise directed by Owner's Project Representative.

G. Do all cutting, filling, compacting fill, rough grading required to bring entire project to within respective base course elevations or 6 inches below finished topsoil elevations.

3.11 GRADING AROUND TREES

A. Limit excavation, fill or grading near trees or other vegetation to the extent possible. When tree roots are encountered, cut roots cleanly and squarely. No excavation, trenching or backfilling within the fenced drip-edge of existing trees shall occur without authorization from DFD Construction Representative.

3.12 TEMPORARY BERMS AND STORM SEWERS

A. Contractor shall provide temporary asphalt or concrete berms to direct storm water away from excavations.

B. Contractor shall provide temporary storm sewer piping to cross trenches and excavations to keep storm water out of the excavations.

3.13 RESTORATION

A. Restore trenches to proposed grades and surfaces as soon as practicable after backfilling.

B. Remove excess bedding, backfill and spoil material from the site as soon as possible after backfilling is complete, but no later than 1 calendar dates after backfilling is complete.

C. Thoroughly clean all drainage ways, roads, parking lots sidewalks and paved surfaces and remove and dispose all debris and mud.

END OF SECTION 31 23 16