5449 AQUATIC CENTER RENOVATIONS

NMSU Facilities and Services Department
P.O. Box 30001
Las Cruces, NM 88003-8001

Project Manual
Technical Specifications

October 7, 2025

NM STATE UNIVERSITY CARLSBAD

RBM ENGINEERING INC. MECHANICAL ELECTRICAL

AKS ARCHITECTURE, P.C.

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AQUATICS FOR LIFE
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DIVISION 25 – INTEGRATED AUTOMATION – BUILDING CONTROLS

DIVISION 26 – ELECTRICAL

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACTOR QUALIFICATIONS

A. Project Experience

1. The contractor shall be required to demonstrate their experience in projects similar to the scope defined in these documents.
2. The contractor shall demonstrate their experience in remodel work in facilities while occupied and requiring critical timelines and minimized work durations.

1.2 PROJECT SPECIFIC REQUIREMENTS

A. The owner has the following requirements for the contractor during the proposed construction:

1. Contractor will be responsible for the development of a complete project schedule that illustrates all of the construction sequences required to complete the project. Contractor will update the owners on a timely and regular basis to insure that the project will be completed as plan.
2. The work will be performed in a dust free environment throughout the construction period. Contractor shall maintain all areas clean on a daily basis.
3. Contractor will be responsible to manage all workers to insure that no damage occurs to all existing lab equipment, walls, floors and ceilings during the performance of the work required to fulfill this contract. Any damage to the existing building will be corrected at contractor's cost.
4. Actual construction on the systems shall not commence until the contractor's design shop drawing submittal is reviewed and approved by the Architect, Engineer, NMSU Manager and NMSU Carlsbad Aquatic Facilities Mangers.
5. Existing conditions walk-thru shall be executed of each space within the work areas prior and after work is executed. This activity will establish Contractor's responsibility as to condition of each space and any damage that may need to be attended by all applicable parties and stakeholders.
6. The contractor shall be responsible for repairing, replacing and/or restoring existing ceiling, wall and floor finishes disturbed as part of the installation/execution of work.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 00 00

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification: 5409 NMSU Aquatic center Renovations.

A. Project Location: Main Campus 1520 Stewart Street, Las Cruces, NM.

B. Owner: New Mexico State University.

1. Owner's Representative: Mr. Jose Loera, Ms. Yvonne Tellez.

C. Architect: RBM Engineering, Inc.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The replacement of all swimming pool filters with associated piping revisions.

2. The installation of variable frequency drives for the existing pool recirculation pumps.

3. The replacement or reconnection of pool water conditioning and treatment systems along with related monitoring controls. The installation of new flocculant water conditioning systems.

4. The replacement of the pool main drains for code compliance.

5. The reconstruction of the three chemical storage rooms with new doors, roof deck and ventilation systems. The installation of a new six foot double door for pool filter access. Painting of walls and ceiling components, structure, doors and door frames.

6. The replacement of lighting and the installation of new power distribution to pool lighting being replaced by others.

7. Other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a State of NM pricing agreement contract with the selected contractor.

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in phases, with each phase substantially complete as indicated.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

C. The contractor shall carefully review the University’s Pool schedule for coordination with facility needs and functions..

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to the areas indicated in the drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours coordinated with the owner and NMSU project manager, Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify NMSU project manager, Architect and facility staff not less than 21 days in advance of proposed utility interruptions.
2. Obtain written permission before proceeding with utility interruptions.

D. Restricted Substances: Use of tobacco products and other controlled substances is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

NEW MEXICO STATE UNIVERSITY

SWIMMING AND DIVING

2025-26 SEASON SCHEDULE
(tentative 7/9)

DAYS	DATE	MEET	TIME	LOCATION
Wednesday	**Oct. 1st**	**Crimson & White**	**4:00pm**	**Las Cruces, NM**
Friday	**Oct. 10th**	**UTU/UNM**	**4:00pm**	**Las Cruces, NM**
Saturday	**Oct. 11th**	**UTU/UNM**	**11:30am**	**Las Cruces, NM**
Saturday	Oct 18th	MPSF Open Water Champs	All Day	Long Beach, CA
Saturday	**Oct 25th**	**UNC**	**10:00am**	**Las Cruces, NM**
Friday	Nov. 7th	NAU	11:30am	Flagstaff, AZ
Saturday	Nov. 8th	GCU	11:00am	Phoenix, AZ
Wed-Fri.	Nov. 19-21st	Houston Invite	All Day	Houston, TX
Friday	Dec. 19th	UNT	12:00pm	Denton, TX
Saturday	Jan. 10th	UTRGV	11:30am	Pharr, TX
Thu-Sat.	Jan. 29-31st	NAU Lumberjack Diving Invite	All Day	Flagstaff, AZ
Saturday	**Jan. 31st**	**UNM**	**11:30am**	**Las Cruces, NM**
Wed.-Sat.	Feb. 25th-28th	MPSF Championships	All Day	Pharr, TX
Mon-Wed.	Mar. 9th-11th	NCAA Diving Zone Championships	All Day	Flagstaff, AZ
Thu-Sat.	Mar 12th-14th	CSCAA National Invitational Champs	All Day	Ocala, FL
Wed. - Sat.	Mar. 18th-21st	NCAA Championships	All Day	Atlanta, GA

Rick Pratt, Head Coach
Swimming and Diving
rpratt@nmsu.edu
(575) 646-3120

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Carefully demolish and remove from the site those items scheduled to be so demolished and removed.

B. Buildings and parts of buildings to be demolished include footings, sidewalks noted, and other attachments as directed by the Owner and Architect.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 PRODUCT HANDLING

A. Comply with pertinent provisions of the General Conditions included in this Project Manual.

PART 2 - PRODUCTS

(No products are required in this Section).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PROTECTIONS:

A. Execute all demolition work in an orderly and careful manner with due consideration for any existing structures, including any parts of the surrounding areas which are to remain. Barricade and cover as necessary to protect pedestrians, workmen and adjacent properties. Periodically sprinkle to allay dust. Protect any existing active service lines, indicated or not.

B. Avoid any encroachment on adjacent improvements. Repair and make good any damage to adjoining improvements caused by operations.

3.03 DEMOLITION

A. By careful study of the Contract Documents, determine the location and extent of selective demolition to be performed.

B. In company with the Owner and Architect, visit the site and verify the extent and location of selective demolition required.

1. Carefully identify limits of selective demolition.

2. Make interface surfaces as required to enable workers also to identify items to be removed and items to be left in place intact.

C. Prepare and follow an organized plan for demolition and removal of items.

1. Shut off, cap, and otherwise protect existing public and Owner's utility lines in accordance with the requirements of the public agency or utility having jurisdiction.

2. Completely remove items scheduled to be so demolished and removed, leaving surfaces clean, solid, and ready to receive new materials specified elsewhere.

3. In all activities, comply with pertinent regulations of governmental agencies having jurisdiction.

D. Demolished material (unless salvaged) shall be considered to be property of the Contractor and shall be completely removed from the job site.

E. Use all means necessary to prevent dust and excessive noise from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

F. Salvage

1. Owner has the first right of refusal on all existing items. Contractor to coordinate with the Owner prior to any demolition work.

2. All door hardware – coordinate NMSU Project Manager.

3. All mechanical equipment - coordinate NMSU Project Manager.

3.04 REPLACEMENTS

A. In the event of demolition of items not scheduled to be demolished, promptly replace such items to the approval of the Architect and at no additional cost to the Owner.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Includes metal items required under other divisions such as anchors, bolts, sleeves, lintels, brackets except where specification states that item(s) are to be furnished to the general contractor for installation.

1.02 RELATED REQUIREMENTS

A. Section 09 91 00 – Painting and Coating

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Guarding floor and wall openings and holes; current edition.

B. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.

C. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.

D. ALI A14.3 - Ladders - Fixed - Safety Requirements; 2008.

E. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

F. ANSI/ASSP Z359.11 - Safety Requirements for Full Body Harnesses; 2014.

G. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems; 2009.

H. ANSI/ASSP Z359.15 - Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems; 2014.

I. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems; 2016.

J. U.S. Occupational Safety and Health Administration (OSHA) ALACO aluminum ladders are certified to meet OSHA/ANSI A14.3 standards for fixed wall ladders.

K. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

L. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

N. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

O. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

P. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

Q. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

R. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless

Carbon Steel Structural Tubing; 2014.

S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

T. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

V. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

W. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

X. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

Y. SSPC-SP 3 - Power Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16, and ANSI A14.3 requirements.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M, u.n.o.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

D. Plates: ASTM A283/A283M.

E. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

F. Fasteners: Provide stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs, sharp edges or rough areas on exposed surfaces.

D. Continuously seal joined members by continuous welds.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

I. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish interior, galvanize finish at exterior wall.
   1. Provide shelf angles as sized and shown on drawings with anchor devices. Install as masonry work progresses. Keep minimum 1/4 inch gap between members. After mason places compressible filler install angle on filler, securing fasteners and not compressing filler.

B. Lintels: As detailed; prime paint finish interior, galvanize finish at exterior wall.
   1. Provide steel lintels for masonry openings except where pre-cast concrete or reinforced masonry lintels are shown.
   2. Steel shapes or plate lintels for all miscellaneous openings in masonry over such items as ducts, doors, recessed equipment, etc. Consult drawings for extent of such openings and lintels.

C. Anchor Devices: Inserts and anchoring devices for all metal work this section. Anchors, tie bolts, inserts, hangers etc. to anchor and support other construction to concrete, masonry or steel.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for finish.
   2. Exceptions: Galvanize items specified for galvanize finish.

3. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP3.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Install ladder safety system in accordance with manufacturer's instructions.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment

until completion of erection and installation of permanent attachments.

D. Field weld components as indicated on drawings.

E. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Non-structural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Subflooring.

F. Roofing nailers.

G. Preservative treated wood materials.

H. Fire retardant treated wood materials.

I. Miscellaneous framing and sheathing.

J. Communications and electrical room mounting boards.

K. Concealed wood blocking, nailers, and supports.

L. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 07 54 23 – Thermoplastic Membrane Roofing

B. Division 08 – Doors and Windows

C. Division 09 – Finishes

D. Division 10 - Specialties

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association.

H. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association.

I. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association.

J. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association.

K. AWPA U1 - Use Category System: User Specification for Treated Wood.

L. PS 1 - Structural Plywood.

M. PS 20 - American Softwood Lumber Standard.

N. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber.

O. SPIB (GR) - Grading Rules.

P. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 and supplements.

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to

prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by the manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.

2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing, Applied to exterior studs as a backup to single-ply roof wall and flashing membranes. FRT.: Plywood, PS 1, Grade C-C, Exterior Exposure.

B. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 1/2 inch.
1. Manufacturers:

a. Georgia-Pacific Gypsum LLC; Product DensGlass Gold.

b. USG Corporation; Product Securock Glass Mat Sheathing Panels.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

D. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.

2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.

3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M or Type 304 stainless steel for high humidity locations, preservative-treated wood locations and fire-retardant treated wood locations; unfinished steel elsewhere.

2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

a. Sustain a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete.

3. Nails, Brads, and Staples: ASTM F1667.

4. Power-Driven Fasteners: NES NER-272.

5. Wood Screws: ASME B18.6.1.

6. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

7. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Water-Resistive Barrier: As specified in Section 07 25 00.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. Use treatment that does not promote corrosion of metal fasteners.

    c. Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898.

    d. Treat all exterior rough carpentry items as indicated.

    e. Do not use treated wood in direct contact with the ground.

2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

    b. Use treatment that does not promote corrosion of metal fasteners.

    c. Interior fire retardant treated lumber and plywood shall have equilibrium moisture content of not over 28% when tested in accordance with ASTM D 3201 at 92% relative humidity.

    d. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

    e. Treat rough carpentry items as indicated .

    f. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. All wood sill plates, and ledgers in direct contact with concrete or masonry and anchored by ½" diameter or larger fasteners, shall be preservative treated in accordance with applicable AWPA Standards. As defined by Section 2303 of the 2021 International Building Code.

2. All blocking in contact with roofing, sheet metal flashing, sheet metal caps, sheet metal fascias and sheet metal curbs shall be Standard Lumber as specified in Item 2.2, Paragraph A of this section.

3. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B exterior use, Commodity Specification A (Treatment C2) using waterborne preservative containing no arsenic or chromium . For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not affect finishes.

    a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

    b. Treat lumber exposed to weather.

    c. Treat lumber in contact with roofing or flashing including but not limited to roof edge, nailers, curbs, equipment support bases and blocking.

    d. Treat lumber concealed in and in contact with masonry or concrete including but not limited to nailers and blocking.

    e. Treat lumber less than 18 inches above grade in crawlspaces or unexcavated areas.

    f. Treat lumber applied to exterior walls.

    g. Treat lumber in contact with concrete slab on grade.

    h. Treat lumber in other locations as indicated.

4. Preservative Pressure Treatment of Plywood Above Grade: AWPA Use Category UC2 interior use and UC3B exterior use, Commodity Specification F (Treatment C9) using waterborne preservative containing no arsenic or chromium . For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not affect finishes.

    a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

    b. Treat plywood in contact with roofing or flashing including but not limited to roof edge, nailers, curbs, equipment support bases and blocking.

    c. Treat plywood in contact with masonry or concrete including but not limited to nailers and blocking.

    d. Treat plywood less than 18 inches above grade in crawlspaces or unexcavated areas.

    e. Treat plywood in other locations as indicated.

5. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA Use Category UC4A exterior use, Commodity Specification A (Treatment C2) using waterborne preservative .

    a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

    b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

C. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

D. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

E. Fit carpentry to other construction; scribe and cope as required for accurate fit.

F. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

G. Predrill members for fasteners when necessary to avoid splitting wood.

H. Countersink bolt heads, nuts and washers where required. Countersink only depth needed to bring bolt head or nut flush with face of lumber maintaining as much of the secured member wood under anchorage as possible.

3.02 PRESERVATIVE-TREATED WOOD - GENERAL

A. Where wood-preservative-treated lumber is installed adjacent to metal decking, metal flashings or other metal products, install continuous flexible flashing separator, such as a peel-and-stick polymeric membrane, between treated wood and metal.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

    1. Blocking is not required to be treated, unless in contact with concrete slab on grade.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required

by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In wood framed assemblies with attics provide wood fireblocking of gypsum board, wood sheathing or dimensional lumber for draftstopping as required by applicable local code or as indicated.

D. In metal stud walls, provide continuous blocking around door and window openings for anchorage of wood frames and/or trim, securely attached to stud framing.

E. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

F. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

G. Provide the following specific non-structural framing and blocking:

1. Cabinets and shelf supports.

2. Wall brackets.

3. Handrails.

4. Grab bars.

5. Towel and bath accessories.

6. Wall-mounted door stops.

7. Chalkboards and marker boards.

8. Joints of rigid wall coverings that occur between studs.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Secure blocking to metal decking by bolting into supporting structure or through decking into supplemental blocking.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring: Glue and nail to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

C. Wall Sheathing, Glass mat faced gypsum: Secure with long dimension perpendicular to wall studs, with ends over firm bearing, using rust-resistant, bugle or wafer head, coarse thread, 1 1/4 inch length wood fasteners unless otherwise indicated. Attach with screws spaced 8 inches on center at perimeter where there are framing supports and 8 inches on center along intermediate framing in the field.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.

3. Install adjacent boards without gaps.

4. Size and Location: As indicated on drawings.

3.05 FIRE RETARDANT TREATED PLYWOOD

A. Lumber: Do not rip or mill fire retardant treated lumber. Cross cuts, joining cuts, and drilling holes are permitted.

B. Plywood: Fire retardant treated plywood may be cut in any direction.

3.06 CLEANING

A. Waste Disposal:

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

- END OF SECTION -

SECTION 07 54 23

THERMOPLASTIC MEMBRANE ROOFING (TPO - FULLY ADHERED)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Documents specifically related to this section include:
   1. Section 01 31 00 – Project Management and Coordination: Coordination of roofing work with Owner; roofing sequence inclusion in Project Schedule.
   2. Section 01 40 00 – Quality Requirements: Roofing observation services and reports; Contractor's responsibilities.
   3. Section 07 62 00 – Sheet Metal Flashing and Trim
   4. Section 07 92 00 – Joint Sealants

1.02 SUMMARY

A. Furnish and install a weather and watertight adhered TPO single-ply roof complete, in place, per the Contract Documents.

B. Major new system components include the following:
   1. Insulation – loose laid at metal decks
   2. Cover board - mechanically attached at metal decks
   3. Single-ply TPO membrane, fully adhered
   4. Single-ply TPO flashings, fully adhered

C. The latest Manufacturer specifications and installation techniques are to be followed. When the Contract Documents and Manufacturer's requirements are in variance with each other, the most stringent requirements of the two shall typically apply at no additional cost to Owner or resulting change in Contract.

1.03 CODE COMPLIANCE

A. The completed roof system shall meet the following requirements:
   1. Building Code: IBC 2021, NMBC 2021
   2. Energy Code: IECC 2021, NMECC 2021
   3. External Fire Rating: UL Class A external fire rating.

B. The completed roof system shall meet design wind load pressures calculated in accordance with the applicable building code. The specified roofing assembly must have been successfully tested by a qualified testing agency to resist the design uplift pressures calculated according to ANSI/SPRI WD-1 "Wind Design Standard Practice for Roofing Assemblies" , American Society of Civil Engineers (ASCE 7), and the International Building

Code (IBC).

C. The completed roof system shall meet the following design wind load pressures calculated in accordance with the applicable building code:

1. Field: -43.54 psf

2. Inner Perimeter: -43.54 psf

3. Outer Perimeter: -57.38 psf

3. Corners: -78.19 psf

D. Perimeter and corner areas shall be calculated based upon the applicable building code requirements.

E. 2021 NM Energy Code and IECC Requirements: Per Table C402.3, roofs must comply with:

1. Three-year-aged solar reflectance of 0.55 and 3-year aged thermal emittance of 0.75 or Three-year-aged solar reflectance index of 64.

1.04 QUALIFICATIONS

A. Manufacturer Qualifications:
1. The Manufacturer of the roofing system shall have not less than five (5) years of experience in the production of the specified system.

B. Installer Qualifications:
1. The installer of the roofing shall have been engaged in the business of installing the specified roofing system for not less than five (5) years and shall be certified by the roofing system Manufacturer in the layout and application of this system. The installer shall have successfully installed the specified system as follows:
    a. At least once, and;
    b. At least five (5) years prior to Bid on this Project.
2. The crew shall be composed of experienced and skilled workers in this work.

1.05 QUALITY ASSURANCE

A. Standards: Comply with latest edition of standards specified in this section and as referenced below:
1. The NRCA Roofing and Waterproofing Manual – National Roofing Contractors Association.
2. Membrane Manufacturer's current published specifications, application instructions, and technical bulletins.
3. Annual Book of ASTM Standards, Latest Revision – ASTM International.

B. Qualifications of Installers: Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this

section. In acceptance or rejection of the work, the Owner will make no allowance for lack of skill on the part of the workers.

C. Roofing Inspections: Make all required notifications and secure all required inspections by the Manufacturer of the approved materials to facilitate issuance of the specified roof warranty.

D. Roofing Consultant and Observer: The Owner shall provide the services of a Roofing Consultant Roofing Observer for the purposes of quality assurance in the design and installation of the roofing system. See Subparagraph 1.1-B and other portions of this section for related Contractor's requirements.

E. U.L. Listing: Provide materials bearing Underwriters Laboratories (U.L.) marking on bundle, package, or container, indicating that materials have been produced under U.L.'s classification and follow-up service.

F. The Roofing Contractor shall not subcontract the installation of the roof system covered under this specification to an individual or a firm that is not a full-time employee of the Roofing Contractor's company. Included shall be the following components:
   1. Insulation
   2. Roof Membrane
   3. Membrane Flashings
   4. Roof Walkways

1.06 REFERENCES

A. References: Materials used in this section shall be listed in the latest edition of the following:
   1. Roofing materials and Systems Directory and Fire Resistance Directory – Underwriters Laboratories Inc.

1.07 SUBMITTALS

A. General: Comply with the provisions of the General Conditions of the Contract and Division 01 specification sections. Submittal schedule shall allow ample time for processing and approval prior to Pre-Roofing Coordination Meeting and start of roof system installation work.

B. Product Data:
   1. Most recent copy of Manufacturer's literature applicable to products and specifications to be used.
   2. Complete material list of all items proposed to be furnished and installed under this section.
   3. Letter from Manufacturer stating that the roofing contractor is approved for installation of the specified roofing system.
   4. Manufacturer's recommended methods of installation.
      a. When approved by the Design Professional, the Manufacturer's recommended methods of installation, unless superseded by more stringent requirements in

the Contract Documents, will become the basis for inspecting, and acceptance or rejection of the actual installation procedures used in this Work.

C. Drawings showing the proposed temporary water cutoff detail.

D. Fire Resistance Information: Provide documentation that roofing system, insulation, and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure over deck specified herein.

E. Wind Uplift Information: Provide documentation that rigid insulation, adhered roofing system, and component materials suitable for the structural deck, and that have been tested as a complete system for application and slopes indicated. Provide information on fastening for uplift resistance to meet the applicable Building Code.

F. Insulation fastening patterns for field, perimeter and corner areas and a roof plan clearly showing the perimeter and corner areas to receive increased fastener frequency.

G. Manufacturer's tapered insulation fabrication drawings.

H. Letter from membrane Manufacturer stating acceptance of proposed roof insulation assembly.

I. Sheet metal and flashing shop drawings as required by Section 07 62 00.

1.08 QUALITY ASSURANCE BY ROOF SYSTEM MANUFACTURER

A. The Manufacturer's technical representative shall coordinate all site visits with the Contractor, Owner's Roofing Consultant, and Design Professional a minimum of three (3) business days in advance.

B. After the roof installation is Substantially Complete, the Manufacturer shall inspect the work and inform (by written report) the Design Professional, Contractor, Owner's Roofing Consultant, and the Installer of defective/incomplete work to be remedied. Those areas indicated shall be corrected to the full satisfaction of the Design Professional, Owner, and Manufacturer. The Manufacturer shall submit written acceptance of the project to the Design Professional prior to Final Completion for issuance of the weathertightness warranty.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in their original unopened containers. Package labels shall indicate material name, production date, and/or product code. Slit Manufacturer-supplied plastic and cover with weatherproof tarps that are securely anchored so as to resist blow off.

B. Store materials in dry, raised, protected areas in an upright position. Control temperature of storage areas in accordance with Manufacturer's instructions. Protect materials from

exposed to the elements. Do not exceed allowable live load of storage area. Store all goods on end.

C. Use all necessary means to protect the materials in this section before, during, and after installation, and to protect the work and materials of all other trades.

D. In the event of damage to roofing and related work or building components, immediately make all necessary repairs and replacements subject to the approval of and at no additional cost to the Owner.

E. Wet, damaged, or defective materials which are intended for incorporation into the new roofing system shall be marked to indicate rejection, and removed from the site the same day as discovered.

F. Securely store and protect materials designated for removal and re-installation as part of the re-roofing work.

1.10 SCHEDULING

A. Work is to be performed on a daily basis with each section completed before progressing to the next day's work, unless specifically directed otherwise by the Design Professional.

B. Substantial Completion of roofing work will be defined as the contractually required and weathertight installation of all specified roof preparation, insulation, field membrane, flashings, counter-flashings, sheet metal, fasteners and caulking.

C. All flashings shall be installed concurrently with the roofing membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Design Professional. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, seams and or night seals, the affected area shall be removed and replaced at the Contractor's expense.

D. Once roofing is started, the roofing application must be Substantially Complete within the time period required by the Contract. All punch list items must be complete prior to Final Completion.

1.11 WARRANTY

A. The Roofing Contractor shall warrant all materials and workmanship for a period of two years from the date of acceptance of the completed work by the Owner. The Roofing Contractor shall make good any defects in materials or workmanship that may develop during the two-year period by repairing or replacing such defects at his own expense without cost to the Owner. Roofing Contractor shall use the form entitled "Roofing Contractor's Warranty" provided in this section.

B. The Contractor shall make all necessary notices for warranty purpose to the primary roofing Manufacturer, to secure timely inspections and issuance of the warranty.

C. Upon Final Completion and prior to final payment, Contractor shall pay all required fees,

secure all required inspections, and complete all items necessary to secure and deliver to the Design Professional the following items:

1. Copies of all Manufacturer's punch lists and documentation of completion.

2. Primary Roofing Manufacturer's 20-year no dollar limit (NDL) labor and material, total systems warranty on the form provided in this section. The total system warranty shall include the following:
    a. Roof membrane
    b. Roof membrane adhesion and attachment
    c. Roof membrane flashings
    d. Roof insulation
    e. Roof insulation attachment
    f. Roof system fasteners, termination bars, and other miscellaneous accessories supplied by the roofing Manufacturer

D. The maximum wind speed coverage shall be peak gusts of 99 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.

E. Primary Roofing Manufacturer's warranty shall cover defects in materials and workmanship and shall become effective at the completion of the work. This warranty shall not include any buy-out clauses and shall not be prorated.

F. All warranties shall contain written provision(s) stating that they will be fully transferable at any time during the specified warranty period.

G. Submit all items to the Design Professional within ten days of receipt from the Manufacturer or within ten days of the final inspection.

1.12 ROOFING DATA FORMS

A. Roofing data forms shall be submitted at Project Closeout by Contractor. See Sections 01 7800 and 01 7801 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials used on this project shall be compatible with the existing conditions and with each other.

B. No product shall contain any asbestos or asbestos-related products.

2.02 ACCEPTABLE MANUFACTURERS

A. Products manufactured or accepted by:
    1. Carlisle SynTec Incorporated.

2. Elevate, Formerly Firestone Building Products Company.
3. Johns Manville.
4. Versico Roofing Systems.
4. Substitutions – See Section 01 63 00 Product Substitution Procedures

2.03 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:

1. Thickness: 80 mils, nominal., 60 mils at vertical surfaces
2. Exposed Face Color: White.
3. Physical Properties: Meet or exceed the following physical properties.

Physical Property - ASTM D6878 Requirement:	80-mil
Tolerance on Nominal Thickness, % ASTM D751 test method	± 10
Thickness Over Scrim, in. (mm)	0.034 typical
ASTM D7635 optical method, average of 3 areas	(0.864)
Breaking Strength, lbf (kN)	350 (1.6) min
ASTM D751 grab	425 (1.9) typical
Elongation Break of Reinforcement, %	15 min
ASTM D751 grab method	25 typical
Tearing Strength, lbf (N)	55 (245) min
ASTM D751 proc. B 8 in. x 8 in.	130 (578) typIcal
Brittleness Point, °F (°C)	-40 (-40) max
ASTM D2137	-50 (-46) typical
Linear Dimensional Change, %	± 1 max
ASTM D1204, 6 hours at 158°F	-0.2 typical
Ozone Resistance, no cracks 7X ASTM D1149, 100 pphm, 168 hrs PASS	
Water Absorption Resistance, mass %	± 3.0 max
ASTM D471 top surface only 166 hours at 158°F water	0.90 typical
Factory Seam Strength, lbf (N) ASTM D751 grab method	66 (290) min
Field Seam Strength, lbf/in (kN/m)	40 (7.0) min
ASTM D1876 tested in peel	70 (12.3) typical
Water Vapor Permeance, Perms	0.10 max
ASTM E96 proc. B	0.05 typical
Puncture Resistance, lbf (kN)	400 (1.8) min
FTM 101C, method 2031	450 (2.0) typical

Properties After Heat Aging	
ASTM D573, 32 weeks @ 240°F or 8 weeks @ 275°F	PASS
No cracking when bent around 3" diameter mandrel	No cracking
Weight Change, %	1.0 max
Typical Weights lb/ft² (kg/m²)	0.40 (2.0)

2.04 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

C. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 60 mils thick, minimum, of same color as sheet membrane.

D. Bonding Adhesive: Manufacturers Standard Bonding Adhesive. Provide additional adhesives as recommended by Manufacturer to hold flashings in place. Do no use in seams.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.05 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: Insulation shall be a closed-cell, polyisocyanurate foam core with factory- laminated facers conforming to ASTM specification C1289, Type II, Class 1. Foam core shall have a rated flame spread of 75 or less according to ASTM E

84. Insulation shall have minimum compressive strength of 20 psi (Grade 2) according to ASTM C1289. Minimum R-Value of 5.7 per inch. Insulation shall be supplied in 4' x 8' boards. Insulation thickness as noted on Drawings.

C. Tapered Insulation: Insulation shall be a closed-cell, polyisocyanurate foam core with factory- laminated facers conforming to ASTM specification C1289, Type II, Class 1. Foam core shall have a rated flame spread of 75 or less according to ASTM E 84. Insulation shall have minimum compressive strength of 20 psi (Grade 2) according to ASTM C1289. Insulation shall be supplied in 4' x 8' boards and fabricated to meet slopes in the drawings.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated or if not indicated slope minimum 1/2 inch per 12 inches.

2.06 COVER BOARD

A. Coated Prime Fiberglass-Mat Faced Gypsum Roof Boards:

1. Basis of Design: GP Gypsum, DensDeck® Prime Roof Boards. Equal products by other manufacturers are acceptable.
2. Thickness: 5/8 inch.
3. Width: 4 feet.
4. Length: 8 feet.
5. Weight: 2.5 lb/sq. ft.
6. Surfacing: Primed Fiberglass Mat.
7. Flexural Strength, Parallel (ASTM C473): 100 lbf, minimum.
8. Flute Span (ASTM E661): 8 inches.
9. Permeance (ASTM E96): Greater than 17 perms.
10. R-Value (ASTM C518): 0.67.
11. Water Absorption (ASTM C473): Less than 5 percent of weight.
12. Surface Water Absorption (ASTM C473): Nominal 1.0 grams.
13. Compressive Strength (Applicable Sections of ASTM C472): Nominal 900 pounds per square inch.
14. Flame Spread/ Smoke Development (ASTM E84): Not more than 0 Flame Spread, 0 Smoke Development.
15. Combustibility (ASTM E136): Noncombustible

16. Fire resistance rating (UL 790 and ASTM E108): Class A

17. Mold Resistance (ASTM D3273): Scored a 10

2.07 INSULATION FASTENERS

A. Nailable Deck:

1. Corrosion-resistant, self-tapping, self-drilling #12 screw with #3 phillips head. ¼" hexhead fasteners are not approved. Fastener shall be carbon steel with fluorocarbon, corrosion-resistant coating. Fastener and plate shall meet FM 4470 requirements.

2. Corrosion-resistant, factory-made metal plate.

3. Steel Deck: Fasteners shall be the shortest length to penetrate the top flange of the deck by ¾".

4. Wood Deck: Fastener shall be of sufficient length to provide minimum 1" embedment into wood decking.

5. Fasteners must not penetrate bottom rib of steel deck. Fasteners shall not protrude below the bottom rib of steel deck.

2.08 WALKWAYS

A. Walkways to be an extra layer of tan 80 mil TPO. Adhered and welded per manufacturer's requirements.

B. Provide walkways around roof access points and around all roof top equipment a minimum of 36" wide as shown on the drawings.

PART 3 – EXECUTION

3.01 INSPECTION

A. The Contractor shall be responsible for verifying existence of suitable substrate to accept the roofing system.

B. Installer of roofing system shall examine substrate and conditions under which roofing work is to be performed and shall notify the Design Professional and Owner's Representative immediately of unsatisfactory conditions. Do not proceed with roofing work until unsatisfactory conditions have been corrected in a manner acceptable to Design Professional, installer and Manufacturer.

C. Pre-roofing coordination meeting: Before roofing work may begin, the Design Professional shall conduct a pre-roofing coordination meeting with mandatory attendance required for the Owner's Representative, Owner's Roofing Consultant, primary roofing Manufacturer's technical representative, General Contractor, the

Roofing Contractor, roofing foreman, and all other subcontractors who have any components of their work on or penetrating the roof. The participants shall:

1. As much as is possible by visual inspection and by the cutting of core samples, inspect surfaces and site conditions required to be ready to receive work. Contractor shall verify acceptability of substrate for application of new roofing s system before commencement of installation.
2. Examine roof openings, curbs, pipes, sleeves, ducts, and vents through roof, cant strips, wood nailing strips and reglets in place. Observe if curbs and penetrations have been laid out and installed with adequate vertical and horizontal clearance as required by the Manufacturer to provide the specified warranty.
3. Observe if the condition of surface to receive roof insulation is firm, clean, smooth, and dry.
4. Review the Contractor's schedule for roofing work so that all parties can coordinate essential tasks within the time restraints.
5. Review the responsibilities of all parties in regard to communication and coordination during the roofing portion of the Work, especially in that which pertains to the involvement of the Owner's Roofing Consultant and Observer. See Section 00 72 00 - General Conditions of the Contact and Division 01.
6. Review status of all submittals necessary to be approved prior to the start of the roofing work.
7. Review plans for roofing equipment and materials staging and roofing schedule in coordination with school schedule and traffic patterns.

3.02 DESCRIPTION

A. Preparation and Surface Conditions:
1. Before roof application is started, remove trash, debris, grease, oil, water, moisture, and contaminants that may affect bond of bitumen to substrate.
2. Prepare all surfaces according to applicable specification sections.
3. Protect adjacent areas from damage with tarps or other durable materials.
4. Surfaces scheduled to receive roofing are to be free of any standing water, frost, snow, or loose debris.
5. Substrate is to be smooth, properly sloped, free of sharp projections, and free of obvious depressions.
6. All roof openings, curbs, pipes, sleeves, ducts, and vents through roof shall be solidly set, and cant strips, wood nailing strips and reglets in place before roofing work begins. Verify that all nailers, curbs and penetrations have been laid out and securely installed with adequate vertical and horizontal clearance as required by the Manufacturer to provide the specified warranty.
7. Do not start roof application until defects have been corrected.

B. Installation – General:
1. Perform all related work specified elsewhere necessary for the installation of the specified membrane system.
2. Ensure that fasteners do not penetrate conduit or other miscellaneous items located on the underside of the roof deck.

3. Do not apply roofing materials when water in any form (i.e. rain, dew, ice, frost, snow, etc.) is present.
4. Do not apply roofing membrane during inclement weather or when ambient c conditions will not allow proper application. Consult Manufacturer's technical specifications on cold weather application.
5. Phased roofing system installation shall not be permitted.

3.03 WOOD NAILER INSTALLATION:

A. Nailers are to be installed as per detail drawings.

B. Discard units of material with defects that might impair quality of work and units that are too small to use in fabricating work with minimum joints or optimum joint arrangement.

C. Set nailers to required levels and lines with members plumb and true.

D. Top of perimeter nailers shall be uniformly flush with the top of insulation.

E. Nailers shall be installed with 1/4" gap between ends of adjoining pieces.

F. Nailers shall be fastened in accordance with the following schedule:
1. Fasteners in 6" or wider (nominal) lumber shall be installed in two (2) rows, staggered one-third of nailer width. Listed spacings indicate distance between fasteners in adjacent rows.
2. Two (2) fasteners shall be installed within 3" of each nailer end.
3. Corner fastener spacing shall extend 8' maximum from all outside building corners.
4. Where two or more nailers are installed, each nailer shall be fastened independently.
5. Over all deck types, the bottom nailer shall be fastened using the specified fasteners and 5/8" diameter washers. Countersink washers and fasteners level with top of wood using spade bit or similar method. Fasten subsequent nailers, where specified, using the specified screws without washers.

6. Nailer Attachment Schedule (unless noted otherwise on the drawings)

Attachment Substrate	Perimeter Fastener Spacing (maximum)	Corner Fastener Spacing (maximum)
Structural Concrete	12" o.c.	6" o.c.
CMU (fastener into solid material)	12" o.c.	6" o.c.
Steel Deck	12" o.c.	6" o.c.
Wood	12" o.c.	6" o.c.

3.04 TAPERED INSULATION CRITERIA

A. Tapered insulation crickets and saddles shall be designed in accordance with the NRCA Roof Manual, Membrane Roofing Systems Current Edition, Fig. 48 Guide for Crickets and Saddles, and Fig. 49 Guide for Crickets.

B. Install tapered insulation with slope direction as indicated on the approved shop drawings. Miter cut all panels at valleys for tight fit and alignment throughout valley length.

C. Install tapered saddles in valleys, where indicated on the approved drawings in the sizes shown. End of saddle shall provide for slope into the sump at the drainage device. End of saddle shall be of sufficient width at sump such that flat spots do not occur in valley. Saddle slope shall be twice the field slope, unless otherwise noted on the drawings.

D. When a tapered insulation system is installed along a perimeter edge of uniform nailer height, utilize tapered edge strip along nailers as tapered insulation thickness decreases for smooth transition and for proper support for the membrane system.

E. Utilize tapered insulation panels and tapered edge strips to construct sumps at roof drains, scuppers, and gutters where detailed. Size shall be as shown in approved shop drawings. Delete thermal insulation within sumps, as required, for installation of tapered panels, so as to provide continuous slope down to drainage device, without creating a sharp/steep sloped transition. At no time shall slope within drain sump exceed 1:12, unless otherwise noted in drawings.

F. Install tapered crickets on the upslope sides of all rectangular penetrations with a dimension greater than 18” perpendicular to slope. Cricket slope shall be twice the field’s slope, unless otherwise noted on drawings. Cricket slope less than twice the field slope shall create positive drainage.

G. Utilize tapered edge strip at transitions in construction of more than ¼” to provide a smooth transition and proper support for the membrane system or subsequent insulation layer. Field cut and shape edge strip as required. Direct slope of edge strip so as to provide for proper drainage.

H. Verify that tapered insulation is properly installed according to the approved shop drawings and that no irregularities exist that will result in ponding water in the finished roof system.

3.05 INSULATION AND TAPERED INSULATION INSTALLATION

A. Install only as much insulation as can be covered with roofing membrane and completed before the end of the day's work or before the onset of inclement weather.

B. Neatly fit insulation to all penetrations, projections, and nailers. Insulation should be loosely fitted, with gaps greater than 1/4" being filled with acceptable insulation. Under

no circumstances should the membrane be left unsupported over a space greater than 1/4".

C. Per applicable Energy Code, install required thickness in a minimum of two layers with joints of second layer staggered from joints of first layer a minimum of 12 inches each direction.

D. Areas of damage or broken corners shall be cut out and replaced with pieces 12” x 12” minimum.

3.06 COVER BOARD INSTALLATION – MECHANICALLY ATTACHED

A. Cover board shall be installed with all joints tightly butted and end joints staggered 12” minimum. Insulation shall fit tightly around penetrations.

B. Areas of damage or broken corners shall be cut out and replaced with pieces 12” x 12” minimum, secured in hot asphalt.

C. Fastener spacings shall be required to meet the design wind up-lift resistance, but not less than two fasteners per each piece of insulation.

D. Fasten the top layer of insulation boards with screw and plate type fasteners. Minimum spacing shall be as required to achieve the specified wind up-lift resistance.

E. Any whole or partial insulation board that falls within the perimeter or corner areas shall have the increased fastening applied over the entire board.

3.07 INSULATION / COVER BOARD INSTALLATION - ADHERED

A. Temperature of adhesive, substrate, and ambient conditions shall be within the Manufacturer’s recommended ranges during installation of insulation adhesive.

B. Prepare surfaces to receive polyurethane adhesive as recommended by the adhesive Manufacturer.

C. Seal around all penetrations and roof perimeters to ensure no adhesive drippage below deck level.

D. Install adhesive over the substrate in beads as recommended by the Manufacturer.

E. The minimum application rate shall be as listed below. If the adhesive Manufacturer’s required application rates are more restrictive than those listed, then the Manufacturer’s requirements shall be followed.

Field:	Install beads at a spacing of 12” o.c.
Perimeters:	Install beads at a spacing of 6” o.c.
Corners:	Install beads at a spacing of 4” o.c.

F. Perimeter and corner areas shall be installed per the drawings and specifications.

G. Any whole or partial insulation board that falls within the perimeter or corner areas shall have the increased quantity of adhesive applied over the entire board.

H. Install bottom layer of insulation with all joints tightly butted and end joints staggered 12” minimum. Insulation shall fit tightly around penetrations.

I. Areas of damage or missing corners in all layers shall be cut out and replaced with pieces 12” x 12” minimum, adhered into place.

J. Set insulation into adhesive immediately after application. Do not slide insulation boards through adhesive during placement.

K. Ensure board adhesion by scoring insulation and installing weights over insulation until adhesive has set. Do not remove weights until insulation is firmly attached.

L. If boards can be lifted or moved by hand, they are not sufficiently attached.

M. Additional layer(s) of insulation shall be installed in polyurethane adhesive over preceding layer(s), using procedures specified for the bottom layer.

N. Insulation joints in each layer shall be offset a minimum of 12" from insulation joints in the preceding layer, including all daily tie-off locations.

O. Remove adhesive drips or spillage from all insulation surfaces prior to installing the membrane. If facer damage results, then remove and replace the insulation board. Remove all adhesive that protrudes above insulation board surfaces at joints.

3.07 ROOF MEMBRANE INSTALLATION

A. Install membrane materials in accordance with Manufacturer's current published application instructions for fully adhered system.

B. Design Professional may take a seam sample of approximately 8” x 8” twice daily. Contractor shall be responsible for making watertight each sample area immediately after sample is cut.

C. Apply contact adhesive in a uniform fashion over a properly installed substrate using an approved ¾" nap solvent-resistant paint roller. The adhesive shall be applied in an even coat without holidays, puddles, or other irregularities. Coverage rate shall be as recommended by the Manufacturer depending upon substrate finish. The adhesive shall be allowed to dry completely before installing the membrane. Unroll and position roofing membrane, without stretching, over the approved substrate, allowing sheets to overlap a minimum of 3”.

Once in place, one-half of the sheet's length shall be turned back and the underside shall be coated with adhesive at a rate as recommended by the Manufacturer. When the membrane adhesive has dried slightly to produce strings when touched with a dry finger, the coated membrane shall be rolled onto the previously coated substrate being careful to avoid wrinkles or air pockets. Do not allow adhesive on the underside of the membrane to dry completely. The amount of membrane that can be coated with adhesive before rolling into substrate will be determined by ambient temperature, humidity and crew. The bonded sheet shall be pressed firmly in-place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. The remaining un-bonded half of the sheet shall be folded back and the procedure repeated.

D. Laps in the membrane sheets shall be installed in a shingled manner in the direction of drainage as not to restrict the flow of water.

E. Seaming area is to be clean and free of dust, dirt, and debris. When cleaning is required, follow the Manufacturer's procedures for cleaning.

F. Laps are to be hot air welded using a robot welder. Laps shall be welded daily. All T-laps shall be patched, using heat welded membrane.

G. All seams are to be fully welded a minimum of 1" from the edge of the lap with an uninterrupted flow of black material from the edge of the completed seam.

H. Allow laps to cool and then check for fishmouths and other voids. Repairs are to be made daily by hot air welding.

I. After installation of the field membrane and before installation of flashings, the field membrane shall be secured using one of the following methods:
   1. A nosing or gravel stop detail fastened 12" o.c. on the vertical face of the nailer and 3" o.c. on the horizontal face.
   2. Fastening a batten strip at 6" o.c. through the membrane and into the roof deck.
   3. Fastening a vertically mounted batten strip at 6" o.c. through the membrane and into the substrate.
   4. Fastening the deck flange of a membrane clad metal flashing through the membrane and into a secure nailer at 3" o.c.

3.08 PEEL STOPS

A. Peel stops shall be installed parallel to all exterior roof edges, including parapet walls. One peel stop shall be installed 12" in from the roof edges.

C. Peel stops shall be constructed by installing system fastening bar over the membrane, fastened to the deck at 6" o.c. Install a circular 2" TPO membrane patch, tack welded over the end of each bar or joints between adjacent bars. Strip-in each bar using 8" wide strips of heat welded field membrane material.

3.09 FLASHINGS

A. Flashings shall be constructed and terminated as per the detail drawings. The specified water cutoff sealant shall be applied behind the top edges of the flashings. The top edges of flashings shall be fastened per the Manufacturer's requirements at a minimum, unless superseded by the detail drawings.

B. All flashings are to be totally bonded. Unadhered flashings will not be approved.

C. Flashings are to extend a minimum of 6" onto the roof membrane. The splice must be sealed at least 3" beyond the fastener.

D. Pitch pans are to be avoided. Prior approval from the Design Professional is required for pitch pan use.

E. Existing drain bowls and rings are to be cleaned. Broken or missing strainers, clamping rings, and bolts are to be replaced. All lead flashings in the drain bowl must be removed.

3.10 ROOF WALKWAYS

A. Walkways shall be installed in a neat, orderly fashion and where indicated on roof plan or in specifications.

B. Chalk line walkway location on roof membrane, and position walkway in place using chalk line as a guide.

C. Install walkway with sufficient gaps as not to impede drainage. Do not cover field seams with walkway unless prior approval is obtained from Design Professional and Manufacturer.

D. Walkway shall be installed as per Manufacturer's requirements.

3.11 TEMPORARY WATER CUTOFFS

A. Temporary water cutoffs are to be constructed at the end of each working day to protect the insulation, roofing, building, and building interior from damage due to wind, snow, and rain.

B. Temporary water cutoffs are to be constructed using hot asphalt unless otherwise specifically approved by the Design Professional.

C. Construction of temporary water cutoffs is to be detailed by the Contractor and approved by the Manufacturer and the Design Professional.

D. Temporary water cutoffs and asphalt-contaminated membrane shall be neatly trimmed and removed at the start of the next workday.

3.12 FIELD QUALITY CONTROL

A. Water Test:

1. After completion of the roof and prior to the installation of the cap sheet, a water test, shall be coordinated with the Owner and conducted by the Contractor in the presence of Design Professional. Owner's Roofing Observer, and Owner's Representative The water test shall include the following procedures:
   a. At the direction of the Design Professional, apply simulated rain over all roof areas for at least 15 minutes per area, or as otherwise directed.
   b. In addition to the simulated rain, direct water to all walls, windows, units, penetrations, etc. that occur adjacent to, or within each roof area, using a continuous, unforced hose stream.
   c. Plug all roof drains and scuppers in each drainage area and allow each drain/scupper sump to be filled to a depth of 3-4 inches. Allow to stand for a minimum of 2 hours.
   d. Perform any necessary corrections to defects noted (including the ensuring of positive drainage around all curbs, roof openings and crickets to roof drains or scuppers) during or after the water test procedures. Perform additional testing as necessary to further define sources of any noted leakage.
   e. Contractor shall provide and/or arrange for necessary equipment, supplies, water, etc. as needed to perform these tests. Provide a water truck with an appropriate hose, if necessary.

3.13 PROTECTION

A. Protect building surfaces, rooftop mounted equipment, piping, conduit, etc., against damage from roofing work. Where traffic must continue over finished roof membrane, protect surfaces.

3.14 CLEANUP

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this Section, consult Manufacturer of surfaces for cleaning advice and conform to their instructions.

C. Remove excess materials, trash, debris, equipment, and parts from the work.

D. Repair or replace defaced or disfigured finishes caused by work of this section.

ROOFING CONTRACTOR'S WARRANTY

Trade: _____

Manufacturer and System Installed: _____

Contractor: _____

Contract Number and Date: _____

Project and Location: _____

_____

_____

Area of Roof Installation: _____

Date of Acceptance (Effective Warranty Date): _____

Contractor warrants to Owner that the roofing system identified above have been installed in accordance with the specifications of the contract referenced above, and the specifications of the Manufacturers of all materials used in performance of the work.

Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner's acceptance of the installation, will make good any deficiencies that develop as a direct result of workmanship defects, by repairing or replacing such defects. All corrective work shall utilize materials and installation procedures in strict accordance with the specifications. The Contractor will respond within 24 hours and repair within 5 business days, any leaks or defects in the roofing assembly.

Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner's acceptance of the installation, will maintain all sheet metal flashing in a watertight condition without cost to the Owner.

Contractor's liability hereunder shall be limited to the repair or necessary replacement of any defective component of the work without cost to Owner and shall not include incidental or consequential damages.

CONTRACTOR

By: _____

Title: _____

Company: _____

Date: _____

ROOFING SYSTEM MANUFACTURER'S 20 YEAR WARRANTY

Manufacturer's Warranty Number:

Effective Date: Expiration Date:

Manufacturer Name:
Telephone #: Fax #:
E-Mail:
Address:

School District:
School:
Project:
Project Address:

Total Warranty - Square Footage:
Roof Specification-System Name:
Insulation Type(s):

Designer of Record:
Telephone # Fax#:
E-Mail:
Address:

Roofing Contractor:
Address:
Telephone No.: Fax #:

Other Information:

WARRANTY

1. The Manufacturer warrants to the School District named above, that, subject to the provisions of this document, the Manufacturer will, within 3 business days, at its own expense, make or cause to be made all repairs necessary to maintain the roofing system in a watertight condition during the warranty period stated above which commences on the date of Substantial Completion. System warranty includes:

   A. Roof membrane

   B. Roof membrane adhesion

   C. Roof membrane flashings (except metal or components not furnished by the Manufacturer as part of its advertised system)

   D. Roof insulation

   E. Roof insulation attachment / adhesion

   F. Roof system fasteners, termination bars, and other miscellaneous accessories supplied by the roofing Manufacturer

   G. Roof related sheet metal (edge metal, copings, counterflashing) supplied by the Manufacturer.

   H. Metal component strip-in-plies.

   I. Roof system attachment / adhesion to the building code defined design wind speed.

2. OWNER'S RESPONSIBILITY: The Owner will notify the Manufacturer if repairs covered by the Warranty are required. The notice will be by, Telephone, Fax, E-mail, or Mail, to the Manufacturer's office listed above within 30 days of discovery of leaks or other defects in the roofing system. The Owner will provide the Manufacturer free access to the building during regular business hours over the life of the Warranty. The Owner acknowledges that the Manufacturer has provided its Roofing Maintenance Manual, including instructions necessary for the Owner to inspect and maintain the roofing system during the warranty period.

3. EXCLUSIONS: The following are excluded from this Warranty:

   A. Roof maintenance for corrections of conditions other than leaks.

   B. Damage to any part of the building (other than the roofing system) or to its contents (consequential damages).

   C. Damage resulting from repairs made to the roofing system without the Manufacturer's prior authorization.

   D. Damage resulting from any one of the following:

      1. Settlement, expansion, contraction, cracking, warping, deflection or movement of roof deck, walls, coping structural members or building foundation.

      2. Natural disasters (i.e., windstorm (in excess of wind speed defined in 1. I. above), hail, flood, hurricane, cyclone, lighting, tornado or earthquake).

      3. Changes in building usage; new installations on, through or adjacent to the roofing system made after the effective date of this Warranty, unless the Manufacturer has given prior written approval of such changes in building usage or new installations.

      4. Accidents, vandalism or other uncontrollable events.

      5. Lack of positive drainage (standing water) for asphalt built-up systems.

      6. Chemical attacks on the membrane from sources unknown or not present at time of roofing installation.

      7. Falling objects, misuse or abuse of the roofing system, traffic, recreational activities or storage of material on the roofing system.

      8. Infiltration or condensation of moisture in, through or around walls, copings, building structure or underlying or surrounding areas.

      9. Movement or deterioration of metal components adjacent to the roof (except where such components are a part of the Manufacturer's advertised roofing system).

      10. Failure of materials supplied by others (except where such materials are a part of the specified roofing system certified by the Manufacturer prior to bidding the roofing work).

      11. Tests or test cuts not authorized by the Manufacturer.

12. Failure of the Owner to provide maintenance in accord with the Roofing Maintenance Manual.

13. Failure of the Owner to notify the Manufacturer of leaks or other defects within 30 days of discovery.

4. The Parties agree that any controversy or claims relating to this Warranty shall be first submitted to mediation under the Construction Industry Arbitration and Mediation Rules of the American Arbitration Association (Regular Track Procedures) or to such other mediation arrangement as the parties mutually agree. Participation in mediation as set forth above shall be a condition precedent to institution of any legal, equitable or arbitration proceedings regarding a controversy or claim relation to this warranty.

5. This is the sole roof system Manufacturer's 20-year warranty, any implied warranty of merchantability and fitness for a particular purpose are excluded.

In Witness Whereof: Manufacturer and Owner have caused this Warranty to be duly executed on the dates below.

MANUFACTURER: a State of Corporation with principal office at:	OWNER:
BY: _____	BY: _____
TITLE: _____	TITLE: _____
DATE: _____	DATE: _____

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through the exterior shell of the building.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Section 07 54 23 – Thermoplastic Membrane Roofing

3. Section 07 92 00 – Joint Sealants

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in current edition of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air conditioning Contractors National Association (SMACNA).

C. Standard commercial items may be used for flashing, trim, reglets, and similar purposes provided such items meet or exceed the quality standards specified.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01 33 00.

B. Product data: Within 45 calendar days after the contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.04 PRODUCT HANDLING

A. Comply with pertinent provisions of the Project Manual and manufacturer requirements.

PART 2 - PRODUCTS

2.01 MATERIALS AND GAGES

A. Where sheet metal is required, and no material or gage is indicated on the Drawings or specifications, provide the highest quality and gage commensurate with the referenced standards.

2.02 GALVANIZED IRON

A. Zinc coating:

1. Provide zinc coating by hot-dip galvanize to all surfaces, unless otherwise noted.

2. Weight:

a. Provide not less than 1-1/4 oz. per sq. ft., nor more than 1-1/2 oz. per sq. ft., to surfaces required to be galvanized.

3. Comply with ASTM A93.

B. Gage: Where no gage is indicated use #24 gage. Use #20 gage minimum for clips. Use 22 gage for gutters, leaders, and leader boxes. Use 16 gage splash pans.

2.03 NAILS, RIVETS, AND FASTENERS

A. Use only soft iron rivets having rust-resistive coating, galvanized nails, and cadmium plated screws and washers in connection with galvanized iron and steel.

2.04 FLUX

A. Where flux is required, use raw muriatic acid.

2.05 SOLDER

A. Where solder is required, comply with ASTM B32.

2.06 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

B. Miscellaneous:

1. Butyl Sealer: Where impracticable to use solder at joints, corners, etc., seal with "DAP Butyl Gutter and Lap Sealer" or "Cushion-Lock CL-50 Butyl Sealer".

2. Coating Asphalt: Brushing consistency, Federal Specifications SS-R-451.

3. Plastic Cement: ASTM D2822.

4. Zinc Dust Primer: Federal Specification TT-E-641.

5. Bird Screen: 2 inch square mesh, 16 gauge steel wire galvanized after weaving; with sheet metal frames.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 WORKMANSHIP

A. General:

1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit and soldering securely.

2. Unless otherwise specifically permitted by the Architect, turn exposed edges back 2".

3. Isolate metal from wood and concrete and from dissimilar metal with two coats of specified asphalted paint or sealer tape. Use only stainless steel fasteners to connect isolated dissimilar metals.

4. Flashings shall have joints at 10 foot maximum spacing and at 2-1/2 feet from corners. Joints shall be butted with 3/16 inch space centered over matching 8 inch long backing plate with sealer tape in laps.

5. Set flanges of flashings and roof accessories on continuous sealer tape on top of envelope ply of roofing. Nail flanges through sealer tape and at 3 inch maximum spacing. Touch-up asphalted paint on flanges.

6. Conceal fastenings wherever possible.

B. Form, fabricate, and install sheet metal so as to adequately provide for expansion and contraction in the finished Work.

C. Weatherproofing:

1. Finish watertight and weather tight where so required.

2. Make lock seam work flat and true to line, sweating full of solder.

3. Make lock seams and lap seams, when soldered, at least 2" wide.

4. Where lap seams are not soldered, lap according to pitch, but in no case less than 3".

5. Make flat and lap seams in the direction of flow.

D. Joints:

1. Join parts with rivets or sheet metal screws where necessary for strength and stiffness.

2. Provide suitable watertight expansion joints for runs of more than 40'-0", except where closer spacing is indicated on the Drawings or required for proper installation.

E. Nailing:

1. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.

2. In general, space nails, rivets, and screws not more than 8" apart and, where exposed to the weather, use lead washers.

3. For nailing into wood, use barbed roofing nails 1-1/4" long by 11 gage.

4. For nailing into concrete, use drilled plug holes and plugs.

3.03 EMBEDMENT

A. Embed metal in connection with roofs in a solid bed of sealant, using materials and methods described in Section 07 92 00 of these Specifications or other materials and methods approved in advance by the Architect.

3.04 SOLDERING

A. General:

1. Thoroughly clean and tin the joint materials prior to soldering.

2. Perform soldering slowly, with a well heated copper, in order to heat the seams thoroughly and to completely fill them with solder.

3. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.

4. Make exposed soldering on finished surfaces neat, full flowing, and smooth.

B. After soldering, thoroughly wash acid flux with a soda solution.

3.05 SPECIAL SHAPES

A. Where shown provide special shapes including but not limited to the following:

1. Sills under windows.

2. Sills under hollow metal frames.

3. Fascias.

4. Metal caps.

3.06 TESTS

A. Upon request of the Architect, demonstrate by hose or standing water that the flashing and sheet metal are completely watertight.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manufactured equipment rails, and pedestals.

B. Roof hatches, manual and automatic operation, including smoke vents.

C. Roof Access Ladders

1.02 RELATED REQUIREMENTS

A. Section 07 54 23 - Thermoplastic Membrane Roofing

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. ; 2009.

D. UL (BMD) - Building Materials Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Maintenance requirements.

5. For smoke hatches, submit evidence of approval by evaluation agency specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 - PRODUCTS

2.01 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:

B. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.

2. Provide the layouts and configurations shown on the drawings.

C. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of rails.

2. Height Above Finished Roof Surface: 8 inches, minimum.

3. Height Above Roof Deck: 16 inches, minimum.

D. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.

1. Height Above Finished Roof Surface: 8 inches, minimum.

2. Height Above Roof Deck: 16 inches, minimum.

2.02 NON-PENETRATING ROOFTOP ASSEMBLIES

A. Manufacturers - Non-Penetrating Rooftop Assemblies:

1. PHP Systems/Design: www.phpsd.com. (Specified)

2. Erico-Caddy

3. Miro Industries.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Penetrating Rooftop Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly.

1. Design Loadings and Configurations: As required by applicable codes.

2. Support Spacing: 8' maximum or as required to distribute load sufficiently to prevent indentation of roofing assembly.

3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

C. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.

1. For Electrical and Gas Lines 2-1/2 inches (64 mm) in Diameter or Less, up to 10 inches (254 mm) above roof: Portable Pipe Hanger Model number: SS8R

1. For Electrical and Gas Lines 3-1/2 inches (89 mm) in Diameter or less, up to 16 inches (406 mm) above roof: Portable Pipe Hanger Model number PP10.

2. For Gas Lines 4 to 6 inches (100-150 mm) in Diameter, up to 12 inches (305 mm) above roof: Portable Pipe Hanger Model number RB18.

3. For single Electrical and Gas Lines 3 to 8 inches (80-200 mm) in Diameter: Portable Pipe Hanger Model number PS 1-2.

5. For Multiple Lines: Portable Pipe Hanger Model number PSE custom.

D. Duct Supports:

1. PHP Model PPH-D, goal Post style.

E. Accessories

1. Un-insulated Piping: Roller support or clevis hanger.

2. Insulated Piping: Band hanger supported from horizontal channel or clevis hanger with Insulation Protection Shield.

3. Conduit: Band hanger supported from horizontal channel.

4. Bracing required when using base with swivel, when pipe exceeds 24 inches (610 mm) above roof, or when thermal expansion of pipe is great.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

B. Roof hatch shall be installed so that distance from roof membrane to top of roof hatch is a minimum of 8 inches.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Throughout the Work, seal and caulk joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture and passage of air.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

C. Scope shall include but not be limited to:

1. Edge of hollow metal door frames and window frames – use NP-1 or equal.

2. Edge of countertops – use NP-1 or equal.

3. Intersection of gypsum board with concrete block, metal, and other dissimilar materials – use NP-1 or equal.

4. Vertical expansion joints and control joints – use Sonolastic 150 with VLM Technology or equal.

5. At all control joints between existing and new precast concrete window sills, parapet cornices, decorative bands (water table), and all other cast concrete elements on all facades of the building. use Sonolastic NP-1.

6. At all places shown or required.

7. Sidewalk and concrete slab expansion joints – use Sonolastic SL1 or equal.

8. At joint between sidewalk and building walls – use Sonolastic SL1 or equal.

9. Caulk all joints in hollow metal frames between vertical and horizontal members. Caulk prior to painting – use Sonoastic 150 with VLM technology or equal.

10. At intersection of hollow metal frames and VCT use NP-1 or equal.

11. At intersection of wall tile base and VCT. Use NP-1 or equal.

12. At all exterior penetrations through walls, ceilings, and roof deck including, but not limited to, doors, windows, vents, electrical conduit and boxes, pipes, etc…

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled personnel who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01 33 00.

B. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Samples: Submit samples to Architect of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.04 PRODUCT HANDLING

A. Comply with pertinent provisions of Project Manual and manufacturer recommendations.

B. Do not retain at the job site material which has exceeded the shelf life recommended by its manufacturer.

PART 2 - PRODUCTS

2.01 SEALANTS

A. Provide the following materials manufactured by Sonneborn (Base Chemical Co.) or equals approved in advance by the Architect, where indicated and where otherwise required for a complete and proper installation.

Material:	Location of use:
1. Sonolastic NP-1 (elastomeric polyurethane sealant)	Throughout the Work, except where other sealant or caulk is specified.
2. Sonolastic SL 1	Horizontal joints exposed to pedestrian and vehicular traffic,

	including concrete decks, sidewalks, and driveways
3. Sonolastic 150 with VLM Technology	Vertical and horizontal joints subject to extreme movement.
4. 3M Fire Block Sealant FB 136	Use in addition to firestopping materials

B. For other services, provide products especially formulated for the proposed use and approved in advance by the Architect.

C. Colors:

1. Colors for each sealant installation will be selected by the Architect from standard colors normally available from the specified manufacturer.

2. Should such standard color not be available from the approved manufacturer except at additional charge, provide such colors at no additional cost to the Owner.

3. In concealed installations, and in partially or fully exposed installations where so approved by the Architect, use standard gray or black sealant.

2.02 PRIMERS

A. Use only those primers which have been tested for durability on the surfaces to be sealed and are specifically recommended for this installation by the manufacturer of the sealant used.

B. At sealant noted in Paragraph 2.1A use Sonolastic Primer 733 and Primer 766 where required.

2.03 BACKUP MATERIALS

A. Use only those backup materials which are specifically recommended for this installation by the manufacturer or the sealant used, which are non-absorbent, and which are non-staining.

PART 3 - EXECUTION

3.01 JOINT PREPARATION

A. The number of joints and the joint width should be designed for a maximum movement specified for sealant.

B. The depth of the sealant should be ½ the width of the joint. The maximum depth is ½" and the minimum is ¼" - Refer to Table 1.

Table 1
Joint Width and Sealant Depth

JOINT WIDTH AT MIDPOINT	SEALANT DEPTH IN
¼ - ½	¼
½ - ¾	¼ - 3/8
¾ - 1	3/8 – ½
1 – 1 ½	½

C. In deep joints, the sealant depth must be controlled by Closed-Cell Backer-Rod or Soft Backer-Rod. Where the joint depth does not permit the use of backer-rod, a bond breaker (polyethylene strip) must be used to prevent three-point bonding.

D. To maintain the recommended sealant depth, install backer-rod by compressing and rolling it into the joint channel without stretching it lengthwise. Closed-Cell Backer-Rod should be about 1/8" (3 mm) larger in diameter than the width of the joint.

E. Between porcelain enameled panels remove old sealant a minimum of ¾" before installing new sealant.

3.02 SURFACE PREPARATION

A. Surfaces must be structurally sound, fully cured, dry, clean, free of dirt, moisture, loose particles, oil, grease, asphalt, tar, paint, wax, rust, waterproofing or curing and parting compounds, and membrane materials.

B Cast stone, and other masonry – clear by grinding, sandblasting, or wire brushing to expose a sound surface free of contamination and laitance.

C. Wood – New and weather wood must be clean and sound. Scrape away loose paint to bare wood. Any coating that cannot be removed must be tested to verify adhesion of sealant or to be determined an appropriate primer.

D. Metal – Remove scale, rust, and coatings from metal to expose a bright white surface. Remove protective coatings as well as any chemical residue or film. Aluminum window frames are frequently coated with a clear lacquer that must be removed before the application of NP 1. Any coating that cannot be removed must be tested to verify adhesion of sealant or determine an appropriate primer. Remove any other protective coatings or finishes that could interfere with adhesion.

E. New Concrete – Remove all loose material from joints by wire brushing. Sandblast surfaces in contract with form-release agents. Fresh concrete must be fully cured. Laitance must be removed by abrading.

F. Old Concrete – For previously sealed joints, removed all old material by mechanical means. If joint surfaces have absorbed oils, remove sufficient concrete to ensure a clean surface.

3.03 PRIMING

A. Sealant NP-1, Sonolastic 150, and SL1 for most applications priming is not required.

1. Check adhesion to surface.

2. For immersion application use primer 733.

B. Apply primer in a thin, uniform film. Avoid build-up of excess primer.

C. Avoid applying primer beyond joint faces. To minimize the contamination of adjacent surfaces, apply masking tape before priming and remove before the sealant has begun to thicken and set.

D. Allow approximately 15 – 20 minutes drying time before applying sealant (primer should be tack free). Priming and sealing must be done on the same work day.

3.04 APPLICATION

A. NP-1

1. Ready to use. Apply by professional caulking gun. Do not open cartridges, sausages, or pails until preparatory work has been completed.

2. Fill joints from the deepest point to the surface by holding a properly sized nozzle against the back of the joint.

3. Dry tooling is recommended. DO NOT use soapy water when tooling. Tooling results in the correct bead shape, a neat joint, and maximum adhesion.

4. For roof tile applications apply a bead of sufficient to make a bond between two tiles on the upper surface of the down slope tile. Install the upslope tile and press into the sealant bead to ensure good contact between the sealant and both tiles.

5. Curing time – skin oven in 24 hours. Functional within days. Full cure 1 week. Immersion service 21 days.

B. SONOLASTIC 150

1. Ready to use. Apply by professional caulking gun. Do not open cartridges, sausages, or pails until preparatory work has been completed.

2. Fill joints from the deepest point to the surface by holding a properly sized nozzle against the back of the joint.

3. Proper tooling ensures the correct bead con-figuration and a neat joint. Equally important, it ensures maximum adhesion to the sides of the joint. For best results, dry tool, DO NOT use water or soapy water to tool. Avoid overtooling of sealant.

4. Best practices dictate that all caulking and sealing be done when temperatures are above 40º F (4º C) to avoid application to moisture-laden surfaces. Moisture on substrates will adversely affect adhesion. Application may proceed as low as 20º F (-6º C) if there is certainty that substrates are completely dry, free of frost, and clean as described under Surface Preparation.

5. Curing time – Skins over in 1 hour. Functional 1 to 3 days. Full cure 1 week.

C. SL-1

1. Fill joints by pouring the sealant from the spouted container or flowing the sealant from a bulk-loading gun or from the cartridge or ProPak.

2. Fill joints from the bottom; avoid bridging of the joint, which may form air voids. Sealant will self level to form a clean joint surface.

3. The maximum depth should be 3/8” (10 mm).

4. Curing time – Skins over in 24 hours. Foot traffic 3 days. Full cure 1 week.

D. Fire Block Sealant FB 136 (if applicable)

1. Follow manufacturer’s installation instructions for required fire ratings.

3.05 CLEAN UP

A. Immediately after use, clean equipment with Reducer 990 or xylene. Use proper precautions when handling solvents.

B. Remove cured sealant by cutting with a sharp-edged tool.

C. Remove thin films by abrading.

3.06 WATER TEST HOLLOW METAL FRAME

A. After completion of caulking of hollow metal frames, water test all exterior glass and panels areas to be determined if water tight. Areas that leak to be re-caulked and then retested.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

1.02 DESCRIPTION OF WORK

A. Provide all steel doors and frames indicated and specified.

B. Grouting of frames is included in this Section.

C. Finish hardware is specified elsewhere in Section 08 71 00.

D. Building in of anchors in masonry construction is specified in other Sections.

E. Glass and glazing are included in Section 08 80 00, if applicable.

F. Access panels to plumbing, plumbing valves and beating valves are included under another section.

G. Hollow metal frames (without doors) noted at toilet rooms.

H. At exterior doors top must not hold water – See paragraph “2.3 G” in this Section.

1.03 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 09 91 00 – Painting and Coating.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2017.

C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) ; 2014.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable ; 2015.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

I. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014 (ANSI/BHMA A156.115).

L. FEMA 361 Design and Construction Guidance for Community Shelters, Second Edition.

M. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

Q. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.

R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

U. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

V. UL (BMD) - Building Materials Directory; current edition.

W. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications; Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Fire Rated Door Assemblies: Where fire-rated assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard Methods of Fire Tests of Door Assemblies" as certified by underwriters Laboratories (UL) or another nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction. Such assemblies, in order to be acceptable, shall be properly labeled.

C. Comply with all applicable code and regulations.

D. Coordination: The Section shall coordinate it requirements with those of other affected Sections, prior to any fabrication. Work in this Section shall accommodate hardware, weatherstrips, etc. So that resulting installation shall be easily and conveniently used as intended.

E. Fabricator: Only fabricator regularly engaged in hollow metal work will be acceptable.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

1. Finish hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1. Provide a schedule of hollow metal work using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule. Include fire rating locations.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.07 QUALITY ASSURANCE

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

D. Store hollow metal work under cover at Project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Republic Doors: www.republicdoor.com.

2. Steelcraft: www.steelcraft.com.

3. Amweld Building Products, LLC: www.amweld.com.

4. Acme: www.acmedoorsandmore.com

5. Commercial Door & Hardware: www.cdhsecurity.com

6. Curries: www.curries.com

7. Ecco : www.eccodoors.com

8. Rocky Mountain Metals, Inc. : www.rockymountainmetals.com

9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Edge and Face Sheet Joining: Mechanically interlocked vertical edges, continuous weld, welds are to be ground and filled to make them invisible and provide a smooth flush surface.

4. Door Top and Bottom Closures: Flush with top/bottom of faces and edges.

   a. Continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet.

5. Door Edge Profile: Manufacturers standard for application indicated.

   a. Edge shall be beveled 1/8 inch.

6. Typical Door Face Sheets: Flush.

7. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.

   a. Form corners of stops with butted hairline joints.

8. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

   a. Doors shall be mortised for hinges. Hinge reinforcements shall be 7 gage steel, drilled and tapped.

   b. Frames shall be mortised for hinges. Hinge reinforcement shall be 7 gage steel, drilled and tapped. Where surface mounted hardware is to be applied,

frames shall have 12 gage reinforcing plates only. Lock jambs shall be mortised for a universal lock strike. Plaster guards shall be provided.

9. Astragals as required on fire rated door; pairs and flush transom.

    a. Provide pairs of doors without astragal at doors rated to 1½ hour with automatic flush bolts.

10. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 MATERIALS GENERAL

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Supports and Anchors: Fabricate of not less that 18 gauge galvanized sheet steel.

D. Inserts, Bolt and Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D, as applicable.

E. Shop Applied Paint: Apply after fabrication.

F. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.04 FABRICATION, GENERAL

A. Provision for the disabled: Comply with applicable parts of ADA regulations.

B. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site. Comply with SDI-100 requirements as follows.

C. Interior Doors: SDI-100, Grade II, heavy duty, Model 1, minimum 18 gauge steel faces.

D. Exterior Doors: SD-100, Grade III, extra heavy-duty, Model 2 minimum 16 gauge steel face.

E. Exterior Full Glass Doors and full glass doors with a center rail shall be SDI'100 Grade III, extra heavy-duty, Model 3, minimum 14 gauge steel tubes. All joints to be full welded, all seams shall be detailed and no visible joints allowed. **Tubular construction only will permitted**.

F. Fabricate frames concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot rolled steel (at fabricator's option)

G. Fabricate exterior doors, panels, and frames from sheet steel. Close top and bottom edge of exterior doors as integral part of door construction or by addition of minimum 16 gauge inverted steel channel, welded into place at top channel must not hold water.

H. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts

I. At exteriors locations, provide door assemblies which have been fabricated with insulating materials.

J. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and template provided by hardware supplier. Reinforce doors and frames for hardware application as shown in Table 1, this section.

K. Reinforce doors and frames to receive hardware as noted in Table 1, this Section. Drilling and tapping for finish hardware may be done at project site. Provide construction that prevents grout from penetrating into unwanted places.

L. Locate finish hardware as indicated in Table II, this Section.

M. Shop Painting not Detailing: Clear treat and paint exposed surfaces of steel doors and frame units, including galvanized surfaces. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface to receive finish paint. **All exposed joints shall be filled or caulked at the factory prior to the final coat of shop primer.** All frames are to receive shop coat of primer.

2.05 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.

1. Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924 A60.

2. Doors shall be 1 3/4 inch manufactured from two 16 gage steel sheets.

3. Core Material: Manufacturers standard core material/construction and in compliance with requirements.

4. Door Thickness: 1-3/4 inch, nominal.

B. Interior Doors, Non-Fire Rated:

1. Face sheets: Made of commercial quality cold rolled steel that complies with ASTM A366 or A620.

2. Doors shall be 1 3/4 inch manufactured from two 16 gage steel sheets.

3. Core Material: Manufacturers standard core material/construction and in compliance with requirements.

4. Door Thickness: 1-3/4 inch, nominal.

5. Door Finish: Factory finished.

C. Fire-Rated Doors:

1. Face sheets: Made of commercial quality cold rolled steel that complies with ASTM A366 or A620.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").

a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD) or WH (Warnock Hersey) - ITS (DIR).

b. Attach fire rating label to each fire rated unit.

3. Core Material: Manufacturers standard core material/construction in compliance with requirements.

4. Door Thickness: 1-3/4 inch, nominal.

5. Door Finish: Factory finished.

2.06 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. General:

1. Gage: 16 gauge steel.

2. Finish: Factory primed, for field finishing.

3. Corners: Head and jamb members shall have diecut mitered corners that interlock rigidly prior to welding. All welds ground smooth and primed.

4. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

5. Jamb anchors: Install 24 inch o.c. maximum, 3 per jamb minimum. Use type required for construction.

   a. At existing openings provide countersunk, flat exposed screws and bolts for exposed fasteners unless otherwise indicated.

6. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

7. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

8. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

9. Where fire-rated door assembly is indicated provide a properly UL labeled door frame.

10. Applied door stops on frames shall be continuously welded to frame.

C. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

D. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

F. Transom Bars: Fixed, of profile same as jamb and head.

G. Door Silencers: Except on weather-stripped frames, drill stops to receive three (3) silencers on strike jamb of single-swing frames and two (2) silencers on heads of double-swing frames. Silencers shall be installed at the factory.

2.07 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners ; prepared for countersink style tamper proof screws.

C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.08 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10 , door manufacturer's standard.

1. Prime finishes on all doors and frames shall meet the ASTM humidity, salt spray, impact and film adhesion test as required by ANSI A224.1. Shop applied red oxide primers are not acceptable.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.09 HOLLOW METAL FIRE RATING LABELS:

A. Doors and/or frames for labeled openings shall bear either a stamped or applied label from Warnock Hersey or Underwriters Laboratory.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install steel doors, frames, and accessories in accordance with final shop drawings. Manufacturer’s data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 “Recommended Erection Instructions for Steel Frames”, unless otherwise necessary for a fire-rated installation.

C. Place frames prior to construction of enclosing walls and ceiling. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

D. Installation of Items of Hardware, including weatherstrips, shall be in accordance with Steel Door Institute Publication SDI-107 as a minimum requirement.

E. In masonry construction, locate three (3) wall anchors per jamb at hinge and strike levels.

F. At existing construction, set frames and secure to adjacent construction with machine screws and proper anchorage devices, or as detailed on the drawings.

G. Install fire-rated frames in accordance with NFPA Std. No. 80.

H. In metal stud partitions, install at least three (3) wall anchors per jamb at hinge and strike levels. In open steel and partitions place studs in wall anchor notches and wire tie.

I. All frames, exterior and Interior. Secure frames to structural members. Do not anchor frames to ceiling construction. Grout all frames in masonry walls as detailed or as directed by the Architect.

J. Door Installation:

1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

2. Place fire rated doors with clearances as specified in NFPA Standard No. 80.

3. Coordinate installation of electrical connections to electrical hardware items.

K. TABLE 1 - HARDWARE REINFORCING GAUGES

HARDWARE	REINF. LOCATION	MINIMUM GAUGE
HINGES	1-3/8’ DOOR 1-3/8” FRAME 1-3/4” DOOR 1-3/4” FRAME	7 GAUGE REINFORCEMENT MINIMUM
MORTISE LOCKSETS AND DEADLOCKS	EVERY DOOR AND FRAME	14 GAUGE
FLUSH BOLTS AND FOOT BOLTS	EVERY DOOR AND FRAME	14 GAUGE
BORED OR CYLINDRICAL LOCKS	EVERY DOOR AND FRAME	14 GAUGE
SURFACE APPLIED	EVERY DOOR	12 GAUGE

CLOSERS	AND FRAME	MINIMUM
HOLD OPEN ARMS	EVERY DOOR EVERY FRAME	SAME AS FOR CLOSER
PULL PLATES & BARS WALL & FLOOR TYPE HOLDER STRI	EVERY DOOR	NOT REQUIRED
KICK & PUSH PLATES	EVERY DOOR	NOT REQUIRED
PANIC DEVICES	EVERY DOOR	14 GAUGE REINFORCEMENT MINIMUM
STRIKES-ON H.M. MULLIONS	MULLION FOR STRIKE ATTACHMENT.	14 GAUGE PLATE ON SURFACE

Gauges listed are minimum. Material found not in comply with listed requirements will be replaced at no cost to Owner. See Table II for locations of hardware.

TABLE II - HARDWARE LOCATION

HARDWARE	LOCATIONS
LOCKS, LATCHES, ROLLER LATCHES, & DOUBLE HANDLE SETS	CENTERLINE OF LOCK STRIKE 40-5/16" ABOVE FLOOR.
CYLINDRICAL OR MORTISE DEADLOCKS ABOVE FLOOR	CENTERLINE OF STRIKE 45"
PUSH PLATES	CENTERLINE 45" ABOVE FLOOR
PULL PLATES	CENTERLINE OF GRIP 42" ABOVE FLOOR
COMBINATION PUSH BAR	CENTERLINE 42" ABOVE FLOOR
PANIC DEVICES	CENTERLINE OF STRIKE 40-5/16"
TOP HINGE	9-3/4" FROM RABBET SECTION OF
BOTTOM HINGE	10-3/8" FROM FINISHED FLOOR TO HINGE CENETRLINE
INTERMEDIATE HINGE	EQUALLY SPACED BETWEEN TOP AND BOTTOM HINGE.

CAUTION: CONSULT WITH THE ARCHITECT FOR SPECIAL LOCK AND STRIKE LOCATION FOR LOWER GRADES IN SCHOOL CONSTRUCTION, PRIOR TO FABRICATION OF ANY MATERIALS

3.02 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.03 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

- END OF SECTION -

SECTION 08 16 13

FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes The Following:

1. Fiberglass Reinforced Plastic (FRP) Doors

2. Fiberglass Resin Transfer Molded Door Frames

1.02 RELATED SECTIONS

A. Related Sections Include The Following:

1. Division 0 – Bidding and Contract Requirements

2. Division 1 – General Requirements

3. Division 8 – Finish Hardware

4. Division 8 – Glazing

1.03 QUALITY ASSURANCE

Test certification by an independent and accredited laboratory is required for the properties listed in this Quality Assurance section. Reports shall be made available upon request for each of the standards and certifications described below.

A. Reference Standards

1. Door Properties:

a) Standard test method for steady state thermal transmission properties by means of the heat flow meter apparatus.

b) Successfully completed 1,000,000 cycles test in accordance with:
AAMA 920-03 – Specification for Operating Cycle Performance of Side-Hinged Exterior Door Systems.
ANSI A250.4-2001 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
NWWDA TM-7 Test Method to Determine the Physical Endurance of Wood Doors and Associated Hardware Under Accelerated Operating Conditions.

c) Florida Building Code

SFBC PA 201 Impact Procedures for Large Missile Impact
SFBC PA 202 Uniform Static Load on Building Components
SFBC PA 203 Products Subjected to Cycle Wind Pressure
SFBC 3603.2 Forced Entry Test
ASTM E 1886 Impact and Cycling, Large Missile Impact
ASTM E 1996 Specifications for Performance of Exterior Doors
ASTM C 518 Heat Transfer
ASTM D 1761 Mechanical Fasteners

2. Laminate Properties:

a) Door face plate is a minimum of 0.125 inch thick fiberglass reinforced plastic molded into one continuous sheet starting with a 25 mil resin-rich gelcoat layer resin integrally molded with multiple layers of 1.5 oz. sq ft fiberglass mat and one layer of 18 oz per square yard fiberglass woven roving saturated with special resin. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass resin.

b) Laminated plate by itself evaluated in accordance with Florida Building Code TAS 201 Large Missile Impact Test as per ASTM-1996-05b, Standard Specification for Performance of Exterior Windows, Curtain Wall, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes. The missile (a 2 x 4 with a weight of 9 lbs shot from a cannon at a velocity of 50 ft/sec) did not penetrate the door face plate.

c) ASTM D 638 Tensile Strength Properties of Plastic

d) ASTM D 790 Flexural Strength Properties of Plastic

e) ASTM D 2583 Indention Hardness of Plastics

f) ASTM D 256 Izod Pendulum Impact Resistance

g) ASTM D 792 Density/Specific Gravity Of Plastics

h) ASTM D 1761 Mechanical Properties of Fasteners

i) ASTM E 84 Surface Burning Characteristics of Materials

j) ASTM G 155 Xenon Light Exposure of Non Metallic Materials

k) ASTM D 635 Method For Rate of Burning

l) ASTM D 2843 Smoke Density

m) ASTM D 1929 Self Ignition Temperature Properties

n) SFBC PA 201 Impact Procedures for Large Missile Impact

3. Core Properties

    a) ASTM C 177 Thermal Properties of Materials

    b) ASTM D 1622 Density and Specific Gravity

    c) ASTM E 84 Surface Burning Characteristics of Materials

    d) WDMA TM-10 and TM-5 Firestop ASTM E 152 U.L 10(b)

    e) ASTM E90-04- Sound Transmission Loss

    f) ASTM E413-04- Classification for Rating Sound Insulation

    g) ASTM E1332-90- Standard Classification for Determination of Outdoor-Indoor Transmission Class

    h) ASTM E2235-04- Standard Test for Determination of Decay Rates for Use in Sound Insulation Methods

B. Qualifications

1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of 30 years documented experience and with a record of successful in-service performance for the applications as required for this project.

2. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.

3. Source limitations: Obtain fiberglass reinforced plastic doors and resin transfer molded fiberglass frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames. This ensures complete uniformity of physical properties and consistency in the resin chemistry tailored for this application.

4. Source limitations: Hardware and accessories for all FRP doors as specified in Section 08 71 00 shall be provided and installed by the fiberglass door and frame manufacturer.

5. Source Limitations: Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related section, Division 8, Glazing.

1.04 SUBMITTALS

A. Product Technical Data Including:

1. Acknowledgment that products submitted meet requirements of standards referenced.

2. Manufacturer shall provide certificate of compliance with current local and federal

regulations as it applies to the manufacturing process.

3. Manufacturer's installation instructions.

4. Schedule of doors and frames indicating the specific reference numbers used on the owner's project documents, noting door type, frame type, size, handing and applicable hardware.

5. Details of core and edge construction. including factory construction specifications.

6. Certification of manufacturer's qualifications.

B. Submittal Drawings for Customer Approval Shall be Submitted Prior to Manufacture and Will Include the Following Information and Formatting:

1. Summary door schedule indicating the specific reference numbers as used on owner's drawings, with columns noting door type, frame type, size, handing, accessories and hardware.

2. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.

3. Drawing showing dimensional location of each hardware item and size of each door.

4. Individual part drawing and specifications for each hardware item and FRP part or product.

5. Construction and mounting detail for each frame type.

C. Samples:

1. Provide one complete manufactured door sample which represents all aspects of the typical manufacturing process, including molded in gelcoat color and face plate construction. One edge should expose the interior of the door depicting the unique u-shaped continuous piece stile and rail, hardware reinforcement and core material.

D. Operation and Maintenance Manual

1. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use condition.

2. Include one set of final as built drawings with the same requirements as mentioned in Section B above.

3. Include certificate of warranty for door and frame listing specific door registration numbers.

4. Include hardware data sheets and hardware manufacturer's warranties.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Each door and frame shall be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.

1. Doors shall be stored in the original container on edge, out of inclement weather for protection against the elements.

2. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

1.06 WARRANTY

A. All fiberglass doors and frames have a lifetime guarantee against failure due to corrosion. Additionally, fiberglass doors and fiberglass frames are guaranteed for ten years against failure due to materials and workmanship, including warp, separation or delamination, and expansion of the core.

B. On site assistance available.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

A. Basis of Design: Chem-Pruf Door Co., Ltd., P.O. Box 4560 Brownsville, Texas 78523 Phone: 1-800-444-6924-7943, Fax: 956-544- 7943, Website: www.chem-pruf.com

B. Substitutions may be considered provided manufacturer can comply with the specifications as written herein and said products are manufactured in the United States of America. Requests for substitution must be submitted in writing no less then 10 days prior to bid date. Substitution request to include a physical sample and written documentation that product will meet the specific manufacturing methods as highlighted below.

2.02 FRP DOORS

A. Doors shall be made of fiberglass reinforced plastic (FRP) using Class 1 premium resin with no fillers that is specifically tailored to resist chemicals and contaminants typically found in environment for which these specifications are written. Doors shall be 1 ¾ inch thick and of flush construction, having no seams or cracks. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer. Components obtained through various outside sources for plant assembly will not be accepted.

B. Door Plates shall be 0.125 inch thick minimum, molded in one continuous piece, starting with

25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving. Each layer shall be individually laminated with resin as mentioned above. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass to resin. Plate alone to withstand Large Missile Impact per FBC TAS 201. Face plates manufactured using the pultrusion process does not allow for a smooth molded gelcoat finish, the use of woven roving for adequate plate thickness, strength and weight, or the appropriate glass to resin ratio and will not meet the quality standards of this project.

C. Stiles and Rails shall be constructed starting from the outside toward the inside, with a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints and disparate materials used to form the one-piece stile and rail.

D. Core material shall be Polypropylene plastic honeycomb core with a non woven polyester veil for unparalleled plate bonding, 180 PSI typical compression range unless otherwise requested.

E. Internal Reinforcement shall be #2 SPF of sufficient amount to adequately support required hardware and function of same.

F. Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat results in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

G. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Fiberglass retainers, which hold the glazing in place, shall be resin transfer molded with a profile that drains away from glazing. The window retainer must match the color and finish of the door plates with 25 mil of resin-rich gelcoat integrally molded in at time of manufacture. Mechanical fasteners shall not be used to attach retainers. Glass, as specified herein, shall be furnished and installed by door and frame manufacturer. In order to maintain uniform appearance, product longevity and the corrosion resistance this application requires, window retainers fabricated from Metal, PVC or Vinyl will not be accepted.

H. Louver openings shall be completely sealed so that the interior of the door is not exposed to the environment. Louvers are to be solid fiberglass “V” Vanes and shall match the color and finish of the door plates.

I. Transoms shall be identical to the doors in finish, construction, materials, thickness and reinforcement.

2.03 FRP FRAMES

A. Frames (rated and non-rated) shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames will not be accepted.

B. Finish of frame shall be identical to the door with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat result in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

C. Jamb/Header connection shall be mitered for tight fit.

D. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall be a dense matrix of cloth glass fibers and premium resin with a minimum hinge screw holding value of 1000 lbs per screw. All reinforcing materials shall be completely encapsulated. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.

E. Mortises for hardware shall be accurately machined by CNC to hold dimensions to +/- 0.010 inch in all three axis.

F. Hinge pockets shall be accurately machined by CNC to facilitate heavy duty hinges at all hinge locations, using shims when standard weight hinges are used.

2.04 HARDWARE

A. See Section 08 71 00

B. The special nature of this material requires that all related hardware as specified must be furnished and installed by the door frame manufacturer to maintain product quality and function as well as to ensure sufficient support/reinforcement, precision tooling and proper sealing methods are provided.

PART 3 - EXECUTION

3.01 INSTALLATION CONDITIONS

A. Verification of Conditions

1. Verify openings are correctly prepared to receive doors and frames.

2. Verify openings are correct size and depth in accordance with submittal drawings.

B. Installer's Examination

1. Door installer shall examine conditions under which construction activities of this section are to be performed and submit a written report to general contractor if conditions are unacceptable.

2. General Contractor shall submit two copies of the installer's report to the architect within 24 hours of receipt.

3. Installer shall not proceed with installation until all unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Doors shall be delivered at job site individually crated. Each crate to be clearly marked with the specific opening information for quick and easy identification.

B. All single doors to be shipped completely assembled in the frame with hardware installed. Double doors to be prehung at the factory to ensure a proper fit and that hardware functions properly, then disassembled for shipping purposes.

C. Install door opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

D. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.

E. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.

F. Fire labeled doors, frames and any associated hardware must be installed by qualified professional installers in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.

3.03 ADJUSTING

A. Adjust doors in accordance with the door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.

B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instruction.

3.04 CLEANING

A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

3.05 PROTECTION OF INSTALLED PRODUCTS

A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

- END OF SECTION -

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Gypsum wallboard.

G. Joint treatment and accessories.

H. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry.

B. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute ; 2001 with 2004 supplement. (replaced SG-971)

B. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units ; 2010 (Revised).

C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units ; 1999 (Reaffirmed 2010).

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board ; 2015.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members ; 2014.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing ; 2012.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products ; 2015.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board ; 2013.

I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness ; 2015.

J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs ; 2014.

K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base ; 2014a.

L. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel ; 2013.

M. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel ; 2007a (Reapproved 2011).

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board ; 2014.

O. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels ; 2015.

P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels ; 2013.

Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber ; 2012.

R. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction ; 2010.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials ; 2015a.

T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements ; 2009.

U. ASTM E413 - Classification for Rating Sound Insulation ; 2010.

V. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association ; 2013.

W. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association ; 2008.

X. GA-600 - Fire Resistance Design Manual; Gypsum Association ; 2012.

Y. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc. ; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing , with minimum three years of documented experience.

1.06 DELIVERY,STORAGE AND PROTECTION

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. Protect metal corner beads and trim from being bent or damaged.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions , Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies as indicated on the drawings.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.

2. Dietrich Metal Framing : www.dietrichindustries.com.

3. Marino: www.marinoware.com.

4. Phillips Manufacturing Company: www.phillipsmfg.com.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel (galvannealed coatings are not allowed), of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Minimum Base-Metal Thickness: 0.0179 inch per ASTM C 645, except 0.033 inch for door and window jambs.

2. Exception: The minimum metal thickness and section properties requirements of ASTM C645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E72 using assemblies specified by ASTM C754.

3. Studs: "C" shaped with flat or formed webs with knurled faces.

4. Runners: U shaped, sized to match studs.

5. Ceiling Channels: C-shaped.

6. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

7. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.

a. Products:

1) Same manufacturer as other framing materials.

2) Phillips Manufacturing Co: www.phillipsmfg.com.

C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

E. Ceiling Suspension Systems:

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062 inch diameter wire.

2. Hanger Attachments to Concrete: Powder-Actuated Fasteners or anchors fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers.

3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 12 gauge 0.08 inch in diameter. Provide minimum 8 gauge 0.128 inch wire where ceiling membrane weighs 4 psf or more.

4. Carrying Channels: Cold-rolled, commercial-steel sheet with with a base-metal thickness of 0.053 inch and minimum 1/2 inch wide flanges, depth as indicated.

5. Furring Members: Hat-shaped, rigid furring channels: ASTM C 645, 7/8 inch deep. Cold-Rolled Channels: 0.053 inch uncoated-steel thickness, 3/4 inch deep. Steel Studs and Runners: ASTM C 645.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock, fire-rated type where required..

1. Manufacturers:

a. Armstrong World Industries, Inc. ; Product Drywall Grid Systems: www.armstrong.com.

b. Chicago Metallic Corporation ; Product Drywall Grid System: www.chicagometallic.com.

c. USG Corporation ; Product Drywall Suspension System: www.usg.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company ; ____: www.americangypsum.com.
2. American Gypsum: www.americangypsum.com.
3. CertainTeed Corporation ; ____: www.certainteed.com.
4. Georgia-Pacific Gypsum ; ____: www.gpgypsum.com.
5. Lafarge North America Inc: www.lafargenorthamerica.com.
6. National Gypsum Company ; ____: www.nationalgypsum.com.
7. USG Corporation ; ____: www.usg.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces, ceilings, and soffits, unless otherwise indicated.
2. Type: Fire-resistance rated Type X, UL or WH listed.
3. Thickness:
    a. Vertical Surfaces: 5/8 inch.
    b. Ceilings: 5/8 inch.
    c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
4. Edges: Tapered.
5. Paper-Faced Products:
    a. American Gypsum; EagleRoc Regular Gypsum Wallboard and FireBloc Type X Gypsum Wallboard.
    b. CertainTeed Corporation; ProRoc Brand Gypsum Board.
    c. Georgia-Pacific Gypsum; ToughRock.
    d. Lafarge North America Inc; Regular Drywall and Firecheck Type X and Type C.
    e. National Gypsum Company; Gold Bond Brand Gypsum Wallboard.
    f. USG Corporation; Sheetrock Brand Gypsum Panels.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

1. Application: Vertical surfaces behind thinset tile, except in wet areas.

2. Type: Regular and Type X, in locations indicated.

3. Type X Thickness: 5/8 inch.

4. Edges: Tapered.

5. Products:

a. American Gypsum; AquaBloc ("Greenboard").

b. American Gypsum Company; M-Bloc.

c. CertainTeed Corporation; ProRoc Brand Moisture Resistant Gypsum Board ("Greenboard").

d. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.

e. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.

f. Georgia-Pacific Gypsum; DensShield Tile Backer.

g. Lafarge North America Inc; Watercheck ("Greenboard").

h. Lafarge North America Inc; Mold Defense Drywall.

i. National Gypsum Company; Gold Bond Brand XP Gypsum Board.

D. Exterior Sheathing Board: As specified in Section 06 10 00.

2.04 ACCESSORIES

A. Acoustic Insulation: 1; preformed glass fiber, friction fit type, unfaced. Thickness: 3 1/2 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

1. Product: Tremco Acoustical Sealant manufactured by Tremco Inc.: www.tremcosealants.com.

2. Product: Sheetrock Brand Acoustical Sealant manufactured by USG Corporation: www.usg.com.

3. Product: SCS-100 manufactured by ITW TACC: www.itwtacc.com.

4. Product: AC-20 FTR manufactured by Pecora Corporation: www.pecora.com.

D. Water-Resistive Barrier: As specified in Section 07 25 00.

E. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

F. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, creased paper tape for joints and corners .

2. Ready-mixed vinyl-based joint compound.

3. Powder-type vinyl-based joint compound.

4. Chemical hardening type compound.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

H. Textured Finish Materials: Latex-based compound; plain.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

K. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 PREPARATION

A. Applied Fireproofing: Before applied fireproofing materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed applied fireproofing materials. Where offset anchor plates are required, provide continuous plates fastened to building structure. Do not reduce thickness of applied fireproofing materials below that required for fire-resistance ratings indicated. Protect adjacent applied fireproofing materials from damage.

B. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.03 GENERAL

A. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

B. Do not bridge building expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

C. Install bracing at terminations in assemblies.

3.04 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.

2. Laterally brace entire suspension system.

C. Ceilings Support Suspension Systems:

1. Secure wire hangers to structural support by looping and wire tying, connecting directly to structural member where possible or provide additional framing as required. At concrete decks connect to inserts, clips or eyelets. Do not attach to the metal deck or permanent metal forms.
2. Space main runners 48 inch o.c. maximum and space hangers 48 inch o.c. maximum along runners, except as otherwise shown.

3. Level main runners to a tolerance of 1/1200, measured both lengthwise on each runner and transversely between parallel runners.

4. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

5. Space furring member at 16 inch o.c., except as otherwise indicated.

6. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.

D. Grid Suspension System for Gypsum Board Ceilings:

1. Attach perimeter wall track or angle wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall track. Secure support members to wall member to maintain position not to serve as support.

2. Secure wire hangers to structural support by looping and wire tying, connecting directly to structural member where possible or provide additional framing as required. At concrete decks connect to inserts, clips or eyelets. Do not attach to the metal deck or permanent metal forms.

3. Space cross members at 24 inch o.c., except as otherwise indicated.

4. Level main runners to a tolerance of 1/1200, measured both lengthwise on each runner and transversely between parallel runners.

5. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work with more than 6 inch dimension as required for support of both the drywall construction and other work indicated for support thereon.

E. Studs: Space studs at 16 inches on center.

1. Extend partition framing as scheduled.

2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

3. Install runner tracks at floors, ceilings, tops of walls, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

4. Laterally brace top of studs at 4 foot o.c. if partition does not extend to overhead structure.
5. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

6. Construct framing around plumbing fixture carriers spacing studs as necessary to fit and maintain structural integrity of the studs.

F. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

1. Erect framing for door and sidelight frames plumb.

2. Frame openings with minimum base-metal thickness of 0.033 inch for double jambs and head.

3. Frame duct and similar openings to within 1/4 inch of required size allowing for isolation between framing and penetrating member.

G. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive furring and gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

1. Orientation: Horizontal.

2. Spacing: At 16 inches on center.

3. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

H. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place one bead continuously on substrate before installation of perimeter framing members.

2. Place continuous bead at perimeter of each layer of gypsum board.

3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

a. Apply at least 1/8 inch coating of acoustic sealant on sides and back of rough-in boxes.

b. Acoustic sealant work includes sealing above acoustical ceilings.

c. Install acoustical sealant at both faces of partitions at penetrations.

3.06 BOARD INSTALLATION

A. Comply with ASTM C 840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.

1. Do not place tapered edges against cut edges or ends.

2. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

3. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

4. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch space and trim edge with L-type edge trim. Seal joints with acoustical sealant at sound-rated walls and where indicated.

5. Fit board to ducts, pipes, outlets, etc., which are penetrating wallboard. Seal joints with acoustical sealant at sound-rated walls and where indicated.

B. Single-Layer Non-Rated: Install gypsum board vertically, with ends and edges occurring over firm bearing.

1. At tall and narrow walls, install boards horizontally with end joints minimal and staggered over studs to minimize joints.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Ceilings: Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling.

F. Installation on Framing: Use screws for attachment of all gypsum board .

1. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.07 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated on the drawings.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

2. On each side of all door and window frames. Joint to extend vertically from each corner of the opening.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials, would otherwise be exposed or not covered with other trim.

3.08 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated. In all rooms scheduled for paint finish.

2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated. In all corridors, vestibules, commons for paint finish.

3. Level 3: in concealed plenums and concealed above finish ceilings.

4. Level 2: Behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

6. Level 0: Temporary partitions.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

3. Taping, filling and sanding is not required at base layer of double layer applications.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.09 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.10 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.11 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

- END OF SECTION -

SECTION 09 24 00

PORTLAND CEMENT PLASTER (STUCCO) REPAIR

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK - SUMMARY

A. The intent of the work is to repair and re-coat existing wall area required to be patched. Remove dirt, loose paint and foreign matter. This may also involve, scraping and wire brushing as necessary for direct bond repair assembly.

B. If stucco is deemed to be damaged to the point of requiring removal, new weather barriers, flashing, lathing, and base coat(s) shall be required.

C. An acrylic modified patching and leveling coat is required over all existing and patched stucco locations. This shall be immediately followed by the embedment of a fiber glass mesh for crack suppression.

D. Acrylic base stucco finish will be applied in a number of coats and consistency to match color samples, or in order to match existing.

E. Notification: Contractor shall notify the owner's representative for the inspection of the repair work, prior to the application of the finish coat.

F. Existing Stucco Systems vary in type and thickness. Contractor to verify existing conditions prior to any work.

1.02 SUBMITTALS:

A. Data sheets, MSDS Sheets, application instructions and any ICC-ES code reports. Submit manufacturer's technical information on all products.

1.03 APPLICATOR QUALIFICATIONS:

A. Applicators must have a minimum of five years' experience in the installation of stucco systems.

B. Applicator must be a Currently Listed Applicator of the system manufacturer.

1.04 JOB MOCK-UP (Including finish coat system)

A. 4'x'4' sample panel on same substrate as for project.

B. Show color, texture and workmanship of finish work.

C. Do not proceed with work until sample is reviewed and approved.

D. Maintain sample panel on project site.

1.05 JOB CONDITIONS

A. Environmental Requirements (Cold Weather):

1. Do not use frozen materials in exterior wall finish.

2. Do not apply exterior wall finish to frozen surfaces or surfaces containing frost, or when the weather is forecasted to be less than 40 degrees Fahrenheit within a 48 hour period following application. Or, tent and heat structure for a minimum of 48 hours during and following application.

B. Environmental Requirements (Hot Weather):

1. Do not apply exterior wall finish when ambient temperature is above 110 degrees Fahrenheit or protect stucco from uneven evaporation and excessive heat during and following stucco application for a minimum of 48 hours.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Lath and Trim Accessories: Conform to ASTM C1063 lathing and furring. (for areas of replacement stucco)
1. Exterior components field walls: Minimum 3.4lb expanded metal self-furred to lath to be used in accordance with ASTM C897.
2. Terminations: J-Metal or Stucco stop, general purpose type with expanded or perforated flanges. Plaster stops to be utilized around all through wall penetrations with gaps between the back of the plaster stops and the window or door frames wide enough to installed backer rod and sealant. See manufactures publish details.
3. Corner Reinforcement: (galvanized welded wire, minimum 18 gage): Manufacturer's standard pre-formed corner reinforcement made from 1.7 lbs. (0.059 kg/m2) per square yard of diamond mesh lath.
4. Square Edge Corner Beads: expanded or flanged to suit application. (For square corners).
5. Round-Edged Corner Beads: expanded or flanged to suit application. (For rounded corners).
6. Control Joints: Single component control joints with ¼ inch slots and ¾ inch grounds, or equal.
7. Expansion Joints: Two-piece adjustable expansion joints, free floating adjustments from ¼ inch to 5/8 inch.
8. Weep Screeds: foundation weep screed, with perforations and minimum 3-1/2 inch vertical attachment flange.
9. Fasteners: steel nail or screw of furring type with 1 inch cap of sufficient length for minimum ½ inch penetration into brick, block, concrete or stud system.
10. 3.4lb. per square yard expanded metal strip-lath 4 inches wide to be used at

around all windows, doorways, openings and through wall penetrations.

11. 3.4lb density expanded metal lath for use on all soffits and overhangs as shown on drawings.

B. (New areas of stucco replacement) Scratch and Brown Coats: A cement-based fiberglass reinforced scratch and brown basecoat mix, for replacement of damaged areas as in fill. *Fiber-47 by Parex USA or equal.*

C. WaterProof Basecoat: To be trowel applied over all horizontal surfaces before any primer or finish coats installation. Weather Dry by Parex USA or equal.

D. (New & existing stucco areas) Patching & Leveling coat material for use over all surfaces after any repairs or when new stucco has been installed, prior to the application of finish and primers: Acrylic modified cement based patching and wall leveling material, *121 or level coat by Parex USA or equal.*

E. (New & existing) Crack Suppression: A woven fiberglass mesh that is a minimum of 4.5oz has been treated for alkali resistance. *Standard fiberglass Mesh by Parex USA or equal.*

F. Primer: An acrylic based masonry primer to be tinted, (colored) to the same color as the finish coat. *Tinted primer by Parex USA or equal*

G. Finish Coat: Exterior Wall Finish Coat System: Optimum Finish, an Acrylic based textured finish coat.

1. Color & Texture to match approved samples in texture and color unless otherwise notified. Custom colors may be required.

H. Water: Potable

2.02 MANUFACTURERS

A. Basis of Design: Parex USA, Contact Andy Townes, andy.townes@parexusa.com or 505-338-4433 direct www.parex.com

B. STO Corporation.

C. Dryvit

D. Other Approved Manufacturers if submitted 10 days prior to bid date.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Remove all loose flaking material by scraping with a wire brush or metal scraper. Protect window, door and all adjoining areas during sand or water blasting and during application of patching and or skim and finish coats. Maintain protection for duration of project.

B. If delaminated stucco has exposed substrates, then proceed with one of the following methods of repair:

1. Install new weather barriers, flashings, lathing and accessories followed by new scratch and brown coats over areas of stucco that have been saw cut and removed and are to be replaced or for any areas of new construction.

-or-

2. Install new 2.5lb expanded metal lath over and through existing stucco utilizing fasteners that are long enough to penetrate existing stucco and brick, block or framing substrates a minimum of 1 inch into these substrates. Then follow with a new basecoat at a minimum thickness of 3/8" or more over areas of in-fill.

C. Once scratch and Brown coats have fully cured and are hard, install the waterproof base coats by trowel over all horizontal locations including all parapets, windowsills, etc.

D. Once waterproof basecoats have fully cured, trowel apply the acrylic modified cement based leveling coat material over all existing stucco surfaces and then embed the fiberglass mesh into this wet material. Apply mesh with ends overlapping a minimum of 2 inches. Smooth out and remove all loose edges, wrinkles etc. Pattern of mesh shall not be visible.

E. Thoroughly wet cure all patchwork, basecoats and patchwork areas for 2 days, then air cure an additional 5 days, before application of any primers or finish coats.

3.02 FINISH COAT APPLICATION

A. Wet cure all basecoats, patchwork and leveling coats by misting with water 2 times a day for two days – air cure an additional 5 days before application of any primers or finish coats.

B. Apply primer to all walls in number of coats and thickness to achieve coverage indicated and to provide for a uniform surface to bond the new acrylic finish coat to.

C. Apply exterior walls finish coat to thickness recommended by manufacturer to achieve texture indicated, to match approved sample, using sufficient trowel pressure or spray velocity to bond finish coat to leveling coat.

D. Apply in one pass, working form corner to corner and top to bottom, taking care to avoid staging marks, cold joints etc; these will not be acceptable, and will be required to be repaired or re-coated.

3.03 ADJUST AND CLEAN

A. Patching:

1. Upon completion, point up exterior wall finish coat around trim and other locations where finish coat terminates or meets dissimilar materials.
2. Cut out and replace defective or damaged exterior wall finish coat.
3. Match pointing and patches to surrounding finish coat in form and texture.

B. Curing:

1. Wet cure any skim coats with clean potable water 2 times per day for 2 days, air-cure an additional 5 days.
2. Do not Wet Cure the acrylic based elastomeric finish coats. Air cure only.
3. Protect from wet weather and freezing or excessive temperatures for 24 hours following application.

C. Cleaning:

1. Remove exterior wall finish and protective materials from perimeter trim and adjacent surfaces.
2. Remove all excess materials from the project site.

END OF SECTION

SECTION 09 91 00

PAINTING AND COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. General: Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, match adjacent painted surface; if not in a painted surface, in general match trim color.

2. Elevator pit ladders.

3. Exposed surfaces of steel lintels and ledge angles.

4. Apply transparent finish to all exposed finish carpentry and trim including wood panels on architectural wood casework.

5. Cementitious wood fiber acoustical panels.

6. Mechanical and Electrical:

a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and mechanical equipment, electrical equipment, and grilles, registers and louvers which are not factory prefinished or otherwise indicated, unless otherwise indicated.

b. In finished areas, paint shop-primed items.

c. On the roof and outdoors, paint all equipment that is exposed to weather or to view, including that which is factory-finished. Includes transformers, panels, electrical gear, etc.

d. On the roof, paint all rooftop mechanical equipment, including that which is factory-finished.

e. Paint all exterior gas pipe, including gas pipe on the roof.

7. Mechanical, electrical, utility and custodial spaces: Walls and ceilings or structure, as applicable, be finish painted where visible from normal level viewing. In this situation paint pipe, conduit fittings, accessories, etc., mounted at surfaces or within structure to be painted (more easily painted than masked out). Painting of ducts is required. Painting of piping, conduit, fittings, accessories, etc., positioned away from painted surfaces (not requiring masking to prevent being painted) is not required.

D. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.

2. Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades.

3. Items indicated to receive other finishes.

4. Items indicated to remain unfinished.

5. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

6. Marble, granite, slate, and other natural stones.

7. Floors, unless specifically so indicated.

7. Ceramic and other tiles.

8. Finished metals such as colored anodized aluminum, stainless steel, and similar metals will not be painted.

9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.

10. Exterior insulation and finish system (EIFS).

11. Glass.

12. Acoustical materials, unless specifically so indicated.

13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 – Miscellaneous Metals: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency ; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications ; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials ; 2007.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings ; Fourth Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products and special coatings, including VOC content.

1. For approval of substitute products, provide factory literature showing equality to specified material for Architect approval. List specified material with proposed substitute product.

C. Samples for Initial Selection: For each type of topcoat product indicated.

D. Samples: Submit two paper chip samples, 4x4 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
1. Color schedules will be furnished to Contractor, by Architect, before application of prime coats.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years documented experience.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

C. Apply benchmark samples after permanent lighting and other environmental services have been activated.

D. Locate where directed.

E. Final approval of color selections will be based on benchmark samples.

1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. Paints:

1. Basis of Design: The Sherwin-Williams Company.

a. Paint "Series" are intended to specify type and quality of a paint line which includes white and tint bases. Contractor shall use proper base for color(s) selected including accent colors.

2. Other acceptable manufacturers equal first line products may be submitted after bidding and shall be subject to Architect approval:

a. Diamond Vogel Paints: www.diamondvogel.com.

b. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.

c. Benjamin Moore & Co: www.benjaminmoore.com.

d. Dunn Edwards

e. ICI paints

f. Kwal Hanley

g. Coronado Paint: www.coronadopaint.com.

h. PPG Porter Paints: www.porterpaints.com.

D. Substitutions: Not permitted.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each coating material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

1. Gypsum Board: Interior Latex Primer Sealer ; MPI #50.

2. Steel -- Shop Primer: Interior/Exterior Quick Dry Alkyd Primer for Metal ; MPI #76.

3. Galvanized Steel: Interior Water Based Galvanized Primer ; MPI #134.

4. Aluminum: Interior/Exterior Quick Dry Primer for Aluminum ; MPI #95.

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: As indicated on drawings

1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

A. Structural Steel Exposed to Weather

1. To be shop primed and prepared. Refer to 05 10 00 Structural Steel Framing for shop primer procedures and products.

B. Ferrous Metal

1. Preparation: Remove rust, clean with denatured alcohol or simple green. Mineral spirits are not to be used.

2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry). Volume Solids 64%

3. First Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

4. Final Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

C. Galvanized Metal and Aluminum

1. Preparation: Clean with denatured alcohol or simple green. Mineral spirits are not to be used.

2. First Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series. Volume Solids 44%

3. Final Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series (4 mils wet, 1.3 mils dry per coat). Volume Solids 54%

D. Masonry Block

1. Primer Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry). Volume Solids 52%

2. First Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series. Volume Solids 34%

3. Final Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series (4 mils wet, 1.3 mils dry per coat). Volume Solids 34%

E. Concrete Masonry Unit Sealer

1. 1st Coat: Okon W-2, water base, water repellant sealer; Solids 10%. Install over exterior CMU from grade to top of wall.

2.04 PAINT SYSTEMS - INTERIOR

A. Ferrous Metal – (Exposed Structure)

1. Preparation: Remove rust, clean with denatured alcohol or simple green. No mineral spirits are to be used.

2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5-10 mils wet, 2-4 mils dry). Volume Solids 56%

3. First Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

4. Final Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

B. Ferrous Metal Ceilings - Dry fog/fall

1. Preparation: Remove rust, clean with denatured alcohol or simple green. No mineral spirits are to be used. Remove grease, oil, wax, dust, powdering or scaling. Assure

surfaces are clean and dry prior to application. Clean and spot prime primed metals. Prime bare metal surfaces.

2. First Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83 Series.Volume Solids 37%

3. Final Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83 Series (11 mils wet, 4.5 mils dry).Volume Solids 37%

C. Galvanized Metal and Aluminum

1. Preparation: Wash with denatured alcohol or simple green. No mineral spirits are to be used.

2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5-10 mils wet, 2-4 mils dry). Volume Solids 44%

3. First Coat: S-W Pro Industrical Zero VOC Gloss Acrylic, B66-600 Series. Volume Solids 54%

4. Final Coat: S-W Pro Industrical Zero VOC Gloss Acrylic, B66-600 Series (2.5-4 mils dry per coat). Volume Solids 54%

D. Masonry Block: Concrete, Split Face, Scored, Smooth, High Density, Low Density, Fluted, and Stucco, Cement Board Ceilings. Polysiloxane System: Solvent Based, Gloss Finish:

1. 1st Coat: S-W Kem Cati-Coat HS Epoxy Filler/Sealer, B42-400 Series (14.0-28.0 mils. wet, 10.0-20.0 mils. dry per coat).

2. 2nd Coat: S-W Macropoxy 646-100 Fast Cure Epoxy, B58 Series (7.0-13.5 mils. wet, 5.0-10.0 mils. dry per coat).

3. 3rd Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

F. Concrete (Sealed Concrete):

1. First Coat: ArmorSeal Tread-Plex WB Acrylic Coating, <100g/L VOC

2. Second Coat: ArmorSeal Tread-Plex WB Acrylic Coating, <100g/L VOC

G. Wood - Painted

1. Primer Coat: S-W Premium Wall and Wood Primer, B28W8111 Series (4 mils wet, 1.8 mils dry). Volume Solids 43%

2. First Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series. Volume Solids 34%

3. Final Coat: S-W Pro Industrical Zero VOC Semi-Gloss Acrylic, B66-650 Series (2.5-4 mils dry per coat). Volume Solids 34%

H. Wood - Stain and Varnish

1. Stain: S-W WoodClassics 250 VOC Stains. Volume Solids 4%

2. First Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series. Volume Solids 14%

3. Final Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series (4 mils wet, 1.0 mil dry per coat). Volume Solids 18%

I. Plaster or Drywall (Gypsum Board)

1. Preparation: Brush or wipe sand finish plaster surfaces to remove lightly bonded sand particles before painting.

2. Primer Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 (4 mils wet, 1.5 mils dry). Volume Solids 37%

3. First Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

4. Final Coat: S-W Sher-loxane 800, (5.0-7.0 mils. wet, 4.0-6.0 mils. dry per coat).

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Loose dirt, foreign matter, brushed or scraped off, leaving surface clean and dry before painting.

C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Plaster and Stucco: 12 percent.

3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

6. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Clean dust, dirt, and debris from rooms before interior painting.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Remove or repair existing coatings that exhibit surface defects.

E. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

F. Seal surfaces that might cause bleed through or staining of topcoat.

G. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Preparation of previously painted surfaces:

1. Loose surface materials - scrape and brush well. Sand surface feathering edges.

2. Oily films, clean with thinner and/or as specified for mildew.

3. Dull high gloss surfaces.

4. Remove wax with commercial stripping product.

5. Rust and corrosion - sand or brush to clean metal.

6. Apply primer to repaired or bare areas and finish as specified in paint systems. Apply only finish coat on solid painted surfaces.

7. Paint entire surface from interior corner to interior corner where remodeling work causes patching or revision in the painted surfaces.

I. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

1. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

J. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

K. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

M. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

N. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

O. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

P. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

Q. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

R. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of

phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

S. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

T. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

U. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

V. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

W. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

X. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Y. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
   1. Paint top and bottom of doors same as face and edges. Paint exterior doors same inside and out with exterior paint system.

3.03 APPLICATION

A. A percentage of this project will be finished in accents and deep tone paint system, approximately 33%, in colors specified by the architect, at no additional cost.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Unless specified otherwise, apply paint with brush, spray, or roller as recommended by manufacturer to recommended thickness minimum. Use a spray application on hollow metal doors and door/window frames or other method for a brushless look.

D. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

E. Apply products in accordance with manufacturer's instructions.

F. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

G. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

H. Apply each coat to uniform appearance.

1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

2. Backroll all sprayed applications.

3. Back prime all wood trim.

I. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

J. Wood doors: seal top and bottom edges.

K. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance at no cost to Owner.

L. Sand wood and metal surfaces lightly between coats to achieve required finish.

M. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

N. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

O. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. Touch-up damaged coatings after Substantial Completion.

3.06 SCHEDULE - COLORS

A. In general: Corridors will be painted a different color than rooms.

B. Accent Paint: Accent colors will be selected for exposed steel structure, exposed ducts, hollow metal door frames, hand rails and guardrails.

C. Soffits: Accent colors will be selected for exposed soffits. The vertical surface will be painted a different color than the horizontal surface.

D. Walls: Accent colors will be selected for select walls. A minimum of one wall in each room.

- END OF SECTION -

SECTION 10 10 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide all miscellaneous specialties where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and sections in Division1 of these Specifications.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300.

B. Product data: Within 35 calendar days after the contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.04 PRODUCT HANDLING

A. Comply with pertinent provisions of the Project Manual and manufacturer recommendations.

A. Comply with pertinent provisions of Section 01 63 00.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Materials:

1. Fire extinguishers, cabinets and wall brackets by Larson's Manufacturing Co., Minneapolis, Minnesota, J.L. Industries, Bloomington, NC as approved manufacturer, or equal products upon approval of Architect. Unless otherwise noted all fire extinguishers shall be supplied with a cabinet.

2. General -Fire extinguishers shall be Model MP10, fire class A.B.C. dry chemical, 10 pound capacity, enameled steel shell. Before final inspection fire extinguishers shall be filled and serviced by General Contractor ready for use.

3. Semi Recessed Fire extinguisher Cabinets: Model C-2409-R clear bubble door (Black Letters), enameled steel trim (white) and bracket #B-2. Furnish cabinet at all fire extinguishers unless otherwise noted.

4. Fully Recessed Fire Extinguisher Cabinets: Architectural Series Model 2409, dual clear acrylic door, baked enamel steel door and frame, with bracket. Furnish with fire extinguisher.

5. Wall brackets if required: Model B-2.

B. Installation: Set wood grounds and make recesses as required to set fire extinguishers and cabinets. Follow manufacturer's instructions unless otherwise shown bottom of cabinets 36" AFF.

2.02 DOOR SIGNS AND WALL SIGNS

A. Materials:

1. Regulatory Compliance: All signs shall be designed to meet the stated requirements for color, contrast, letter height, install location and other characteristics required for accessibility and by local, state and federal regulations.

2. Shall meet ADA requirements and CABO/ANSI A 117.1 specifications and shall be similar to "Best Sign System" #HC200 ADA, of "MP" plastic. Colors are selected by Architect. The following manufacturers are approved as equal:

   a. Allen Marking Products.
   b. Design-A-Sign Company.
   c. Lynn Bulletin and Director Board Company.
   d. Best Manufacturing Company.
   e. Allentine.
   f. Z A X Corporation.

g. ANDCO.
h. Seton
j. Century Sign Builders, Albuquerque, NM

3. Door signs shall be custom molded using plastic laminate with wording or numbers. Signs shall be 4 ½ " x length required (4 ½ " minimum length). Mount with adhesive. Braille/Tactile Letters shall be raised 1/32" from plate.

4. Mounting height shall be 40" above the finish floor to the centerline of Braille letters; location on wall adjacent to latch side of door, allowing 4" between edge of sign closet to door and door jamb.

5. Wall signs - similar to paragraph 2 above, 8" x 8".

6. Shall comply with ADA signage requirements.

7. Signs on glass have similar blank plastic laminate on opposite side.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION:

A. Installation of all items shall not begin until the contractor has examined and approved all surfaces and conditions.

B. Where questions about conflict arise, the Contractor shall notify the Architect.

3.02 INSTALLATION

A. Follow all instructions and recommendations of the manufacturers.

3.03 CLEANING AND REPLACEMENT

A. Clean all items prior to final inspection.

B. All items not operating properly or damaged shall be replaced.

- END OF SECTION -

SECTION 131100

SWIMMING POOLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, be included in, and made a part of this Section.

1.02 SUMMARY OF WORK (for general guidance-not inclusive)

A. Introduction

1. Provide labor, materials, equipment, and services necessary to construct the pool(s). This work must include the structure(s) and installation of pool finishes as well as products listed in Part 2 of Section 131100.

B. Work included in this section:

1. It is the intent of this section to place the entire responsibility for the construction of the pool(s) (including the construction of the pool shell(s)) under one vested Contractor. Under this section the Contractor will provide but is not necessarily limited to the following:

   a. Provide equipment and services required for erection and delivery onto the premises the equipment or apparatus provided. Remove equipment from premises when no longer required.

   b. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction. Reference Division 31 - Earthwork.

   c. Provide electrical conduit, wiring, junction boxes etc. to low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)

   d. Coordinate for required bonding and grounding of the pool shell, fittings, and equipment.

   e. Provide necessary piping and valving as shown on the drawings and specified herein.

   f. Provide individually sized housekeeping pads for each pool pump. Provide housekeeping pads for pool equipment as required in the drawings.

   g. Provide for the storage of pool related equipment, materials, and systems. Items are the responsibility of the Contractor until accepted by the owner.

   h. Obtain final acceptance by jurisdictional health department(s).

   i. Start, test, calibrate and adjust mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose,

maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.

2. The following work related to the swimming pools must be completed by other trades.

   a. Provide, erect, and maintain necessary barricades, signs, lights, and flares for pool construction to protect workers and the public.

   b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations. Reference Division 31 - Earthwork.

   c. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange required electrical, plumbing and or building inspections that must be performed on embedded items. Reference Division 26 - Electrical.

   d. Provide sanitary sewer and storm drain connections. Reference Division 22 - Plumbing.

   e. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.

   f. Provide chlorine resistant caulking (sealant) and backer rod on pool decks. Reference Division 7 - Thermal and Moisture Protection.

C. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work that must be completed by others.

1. Provide power to the exhaust fans for the chemical rooms.

2. Provide power to Variable Frequency Drive pool pump starters and power from VFD to the pool pump motor.

3. Ground and bond pool structures, fittings, and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.

4. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.

5. Provide power, conduits, electrical boxes, and wiring for the underwater lights and junction boxes.

6. Confirm electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

1.03 QUALITY ASSURANCE

A. The specifications and drawings illustrate and detail two (2) swimming pool systems that are utilized for both competitive and recreational use. Certain technical aspects of the design are common only to pool systems planned for public use. Understanding these aspects, their functions and interaction through experience is vital to completing a successful operating system. It is a mandatory requirement that the Contractor have achieved such experience as a prerequisite for bidding on this project.

1. The Swimming Pool Contractor to refer to section 002113 – Instructions to Bidders for bonding requirements.

2. The Swimming Pool Contractor must include a bid bond from an approved surety company registered in the State of New Mexico certifying that the Swimming Pool Contractor has adequate bonding capacity to provide a bid for this project. The Swimming Pool Contractor must submit a copy of the bid bond for review prior to the Swimming Pool Contractor's selection.

3. If the Contractor has not received prior written approval for this project or has not been included in the pre-approved list of Contractors, they must submit a list of projects meeting the aforementioned qualifications, including contact information of the General Contractor must be submitted for review and approval at least 10 days prior to bidding of the project. The Contractor must have completed at least five (5) public-use pools with individual water surface areas in excess of 4500 square feet and a depth of 11'-6" or more within the past 10 years.

4. The Contractor must submit prior to the start of construction the name of the on-site Project Superintendent including their relevant experience. The Contractor's on-site Project Superintendent must have completed at least five (5) public-use pools with individual water surface areas in excess of 4500 square feet and a depth of 11'-6" or more within the past 10 years. A list of projects meeting the aforementioned qualifications, including contact information of the General Contractor as well as Owner must be included with the experience submittal. Project Superintendent on the project cannot change unless written authorization has been provided by the Architect and Owner.

5. The Owner reserves the right to reject a bid if the evidence submitted by, or investigation of, the Contractor fails to satisfy the Owner that the Contractor is properly qualified to carry out the obligation of the contract and to complete the work described or if the Contractor does not have the qualifications stated herein. Subject to compliance with item 2 above on this specification.

6. The following Contractors have been pre-approved. The Contractor must meet the requirements listed above.

Atlantis Aquatic Group
Terry Smith
7700 Hwy 71 West
Austin, TX 78735
Phone: 512-243-6877

Wescon Construction, Inc.
Steve Kraft
P.O. Box 1483
7301 Jefferson St., NE
Albuquerque, NM 87109
Phone: 505-345-2511

Sunbelt Pools
Rob Morgan
10555 Plano Rd
Dallas, TX 75238
Phone: 214-343-1133

1.04 REGULATORY AGENCY REQUIREMENTS AND ENGINEERING SERVICES

A. The system must comply with necessary pre-construction approvals.

B. Give necessary notices, obtain permits, and pay government fees, and other costs in connection with his work, including the filing of necessary as-built drawings, prepare documents (including any amendments to the approved construction documents) and obtain necessary approvals of governmental departments having jurisdiction over their work. Obtain required certificates of inspection for his work and deliver copies to the Owner and Architect before requesting acceptance and final payment for the work.

C. Include in the work, without extra cost to the Owner, labor, materials, services, apparatus, or drawings in order to comply with applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and/or specified.

1.05 COORDINATION AND CLARIFICATION

A. Coordinate with other trades' work relating to this section.

B. Must establish with other trades, having related work in this section, that work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

1.06 ALTERNATES

A. Review the description of the alternates in Division 1 and on the drawings for possible effect upon work in this section. Alternates related to the work in this section are described in this division and on the bid proposal form.

1.07 CONTRACTOR'S ALTERNATE PROPOSAL

A. Submit bid to the owner based on materials, equipment and methods as specified in this Section. No substitution of material will be allowed.

B. It is the intent of the contract documents to encourage competition. The base proposal must include the construction methods and equipment as specified and detailed. Proposed system substitutions must have prior written approval by the Architect.

C. If there is a deviation from the basis of design equipment, confirm that engineering criteria are appropriate for the substituted equipment.

D. Substitutions of specified construction methods and equipment must include a complete submittal as required by these specifications and drawings of appropriate scale incorporating required changes. Provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.

E. Changes or modifications to the Contract Documents that are not authorized by the architect are the sole responsibility of the Contractor.

1.08 SUBMITTALS

A. Submittals must be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. One (1) set of shop drawings and engineering data must be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage must include items for the pool shell(s), reference swimming pool structural specifications. The second stage must be for remaining items. Each section of items must be prefaced by a cover sheet listing the items submitted within the section. Electronic submittals must be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.

1. Engineering data covering systems, equipment, structures, and fabricated materials, which will become a permanent part of the work under this contract, must be submitted for review. This data must include drawings and descriptive information in sufficient detail and scale to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, must be provided indicating that equipment will fit in the space allotted and as shown on the drawings.

2. Submittals regardless of origin must be stamped with the approval of the Contractor and identified with the name and number of this contract, Contractor's name, and references to applicable specification paragraphs and contract drawings. Each submittal must indicate the intended use of the item in the work. When catalog pages are submitted, applicable items must be clearly identified. The current revision, issue number, and date must be indicated on drawings and other descriptive data.

3. The submittals will not be accepted from anyone but the Contractor. Submittals must be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

4. The Contractor's stamp of approval is a representation that the Contractor accepts full responsibility for determining and verifying quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.

5. Each submittal must include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.

6. Deviations from the contract documents must be identified on each submittal and must be tabulated in the Contractor's letter of transmittal. Such submittals must, as pertinent to the deviation, indicate essential details of changes by the Contractor (including modifications to other facilities that may be a result of the deviation) and required piping and wiring diagrams.

7. The Contractor must accept full responsibility for the completeness of each submission, and, in the case of a resubmission, must verify that exceptions previously noted have been considered.

8. The need for more than one resubmission, or a delay in obtaining review of submittals, will not entitle the Contractor to an extension of the contract time unless the delay of the work is directly caused by a change in the work authorized by a change order.

9. Review of drawings and data submitted by Contractor will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of dimensions, quantities, and details of the material, equipment, device, or item shown. Review of submittals does not relieve Contractor from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.

10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections must be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.

11. Resubmittals must bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. Resubmittals must be indexed, tabbed, referenced to the specifications, and bound in a three-ring binder and submitted at one time.

12. When corrected copies are resubmitted, the Contractor must, in writing, direct specific attention to revisions and must list separately revisions made other than those called for on previous submissions.

13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies are to be provided unless specifically requested to do so for record.

C. Permits, Receipts and Test Reports

1. Provide the Architect with copies of permits and receipts for fee payments.

2. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.

D. Include complete product data indexed, tabbed, and referenced to specifications with 8 ½" x 11" cover sheet covering:

1. Paragraph 2.01 - Pumping Equipment

2. Paragraph 2.02 - Filtration Equipment

3. Paragraph 2.03 - Recirculation Fittings

4. Paragraph 2.04 - Piping Systems

5. Paragraph 2.05 - Chemical Treatment Systems

6. Paragraph 2.06 - Flow Meters

E. Include engineering construction drawings for pool piping.

1.09 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

A. Detailed operation and maintenance information must be supplied for equipment requiring maintenance or other attention. The equipment supplier and/or the Contractor must prepare an operation and maintenance manual for equipment. Parts lists and operating, and maintenance instructions must be provided.

B. Each operation and maintenance manual must include the following:

1. Equipment function and calibration, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment and checking instructions.

3. Operating instructions for startup, routine and normal operation, regulation, and control, shut down and emergency conditions.

4. One (1) copy of instructional videos.

5. One (1) copy of Safety Data Sheet forms for all pool chemicals provided.

6. Operating cycles must be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram must be provided in the pool equipment room. The diagram must be engraved on laminated plastic with color-coded piping to match the color of coding on piping, and including valves identified with number on tags. The minimum size is 11-inch x 17 inch.

7. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for pool mechanical equipment.

8. Using reference to keyed valves and wall diagram, include specific written instructions for procedures that must be followed for the following:

   a. Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty.

   b. Water level control adjustment and chemical control operation.

   c. Filter operation and backwashing; and

   d. Super chlorination.

9. Lubrication and maintenance instructions.

10. Guide to “troubleshooting.”

11. Parts list and predicted life of parts subject to wear.

12. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.

13. Test data and performance curves, where applicable.

14. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during the period that the pool will be empty. Provide a yellow warning sign 8-1/2 in. x 11 in., that must be mounted in the pool mechanical room, that reads:

WARNING
Prior to emptying Pool

Consult O & M Manuals for Procedures

Add another sign that reads:

Keep Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

15. Additionally, provide the following signs mounted on the chemical room doors:
    a. NFPA Hazard Diamond for each chemical stored in room.
    b. Warning: Authorized Personnel Only Beyond This Point
    c. Signage indicating location of associated Safety Data Sheet forms for all chemicals stored in room.
16. One set of applicable submittals must be included in each manual.

C. The operation and maintenance manuals must be in addition to instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the Contractor.

D. Manuals and other data must be printed on heavy, first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams must be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practical, larger drawings must be folded separately and placed in envelopes that are bound into the manuals. Each envelope must bear suitable identification on the outside.

E. Six (6) bound volumes of each manual must be submitted. Parts lists and information must be assembled in substantial manuals and permanent, three-ring or three-post binders. Material must be assembled and bound in the same order as specified, and each volume must have a table of contents and suitable index tabs.

F. Material must be marked with project identification. Non-applicable information must be marked out or deleted.

G. Shipment of equipment will not be considered complete until the required manuals and data have been received.

H. The Contractor must provide, assemble, and inventory all deck, loose, safety, and maintenance equipment including any loose mechanical equipment prior to the Owner taking possession of the pool(s). The Contractor must provide a checklist that has been signed by the Owner verifying receipt of all items listed in Part 2 - Products.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

1.11 WARRANTIES

A. The Contractor warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The Contractor's warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the Contractor or improper wear and tear under normal use. If required by the Architect, provide satisfactory evidence as to the kind and quality of materials and equipment.

B. The Contractor must agree to repair or replace defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

C. Warranties must be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified. Submit warranties covering, but not limited to the following:

1. Defects in material or workmanship of the pool structure(s) causing a loss of water for a period of one (1) year from any damages caused during construction.

2. Manufacturer's minimum eighteen (18) month warranty against defective materials, components, and workmanship in the variable frequency drive system.

3. Manufacturer's minimum fifteen (15) year warranty on the filter tank against defective materials or workmanship of the tank and components. (Additional warranty time may be purchased from the manufacturer.) Prorated warranties are not acceptable.

4. Defects in material, workmanship, and installation of the pool piping system and recirculation fittings for a period of three (3) years.

5. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pH buffer feed system.

6. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the ultraviolet sanitizing system (excluding the UV lamps, quartz, and seals). Medium pressure ultraviolet bulbs must be warranted for a period of 8,000 hours. Intermittently operated lamps (≥ 1 on/off cycle per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.

7. Manufacturer's minimum three (3) year warranty against defective materials, components, and workmanship in the Clear-Flow Electronic Flocculation System (EFS).

1.12 SYSTEM TRAINING

A. A qualified representative of the Contractor performing work under this section must put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.

B. The Contractor's training representative must have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.

C. The representative from the Contractor must be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.

D. Training periods to consist of 32 hours of on-site training and scheduled as follows:

1. 16 hours of initial training on the complete swimming pool system. The 16 hours of initial training must be comprised of at least 4 hours of training on water chemistry analysis and adjustment. The water chemistry training will include in-depth review of the use of the Langlier index and its computation.

2. The initial 16 hours of training must include information on the care, operation, adjustment, and maintenance of items provided by the Contractor under the "Part 2 – Products" section of this specification.

3. 16 hours of training after the Owner's staff has had experience operating the system. This time may be requested after the pool has been placed in operation within a period of one (1) year from the time the pool was accepted by the Owner. The additional training must contain at least 2 hours of review of water chemistry.

4. Provide a project specific video recording instruction manual in addition to the training sessions. The video instructions must be project specific and must include information on the care, operation, adjustment, and maintenance of items provided by the Contractor under the "Part 2 – Products" section of this specification. This video recording must be done separate from the Owner training.

5. The Contractor must include one (1) copy of video recording instructions in each Operations and Maintenance Manual.

1.13 POOL FILL WATER QUALITY

A. The Owner is to bear the cost of the water required for one (1) complete filling of each of the pools. Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Subsequent fillings or partial fillings (more than 25%) of the pool is by the Contractor, at its own expense.

B. Provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10-degree F.

C. Provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity	60 - 80 PPM
Langelier saturation index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.14 START-UP CHEMICALS

A. The Contractor must maintain the chemical balance of the pool water (including the cost of chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.

B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation after the owner begins using the pool.

1. The Contractor is required to provide chemical quantities as shown on the drawings for the following chemicals:

a. Calcium Hypochlorite

b. Muriatic Acid

c. CO_2

C. Chemicals must be provided to the Owner must include those required by the chemical feed systems provided.

1.15 RECORD DRAWINGS

A. Provide a complete set of record drawings of the entire pool system(s) including sub-systems. Record drawings must be prepared in accordance with the requirements of Section 017839 and must be a complete, stand-alone set. The Contractor is permitted to obtain original documents and copy them for this purpose only. Provide a digital record set (latest version of AutoCAD or compatible software).

PART 2 - PRODUCTS

2.01 PUMPING EQUIPMENT

A. Variable Frequency Drive Starters

1. Provide variable frequency drive starters (VFD) for the pool pumps as indicated on the drawings. VFDs must be Eco-Flow-C by H2Flow Controls, AcuDrive by Pentair, GreenDrive by Neptune Benson, or approved equal.

a. Basis of Design: Eco-Flow-C by H2Flow Controls

2. Ensure that equipment is provided with the correct operating voltage and that interconnected electrical and electronic equipment must adequately communicate and operate the specified pumping equipment. Equipment installations must meet or exceed the requirements of the National Electric Code and other local and state regulations.

3. Variable Frequency Drive Base Requirements

a. Provide complete VFD as specified herein or in the equipment schedule for loads designated that must be variable speed or variable flow.

b. The VFD must convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD must be a six or twelve pulse input design, and the input voltage rectifier must employ a full wave diode bridge. The output waveform must closely approximate a sine wave. The VFD must be of a PWM output design utilizing

current IGBT inverter technology and voltage vector control of the output PWM waveform.

c. Indoor Applications: VFD must be fully enclosed in a corrosion resistant NEMA 12/IP54 UL listed enclosure.

d. VFD and required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect.

e. VFD must have a fused disconnect and battery back-up, for the purpose of maintaining programming in the event of a power outage, or properly rated circuit breaker.

f. The VFD must produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

g. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis and be capable of running the motor at its nameplate RPM, voltage, current, and slip.

h. The VFD will be capable of running variable torque loads. The VFD must be able to provide its full-rate output current continuously and 110% of rated current for 60 seconds.

i. VFD must offer a motor spinning test that will allow the user to determine if the motor is running in the correct direction.

j. Switching of the input power to the VFD must be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

k. Switching of power on the output side between the VFD and the motor must be possible with no limitation or damage to the VFD and must require no additional interlocks.

l. Cooling must be via an aluminum heat sink and must prevent the introduction of ambient air to the electronics for cooling. With the exception of the water-resistant heat sink fan, electronics must be fully sealed within the enclosure.

m. The VFD must have temperature-controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

n. VFD must provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage.

4. Harmonics:

a. The VFD must provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor.

b. The VFD must be provided with line-side harmonic reduction, as required, to ensure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met.

c. Harmonic solutions must be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.

5. Protective Features:

a. VFD must have input surge protection.

b. VFD must include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

c. Printed Circuit boards must be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard.

d. Dry-pump detection must be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer must be included to prevent nuisance tripping.

e. VFD must include two current sensors on output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

6. Interface Features:

a. VFD must provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD Display must have the ability to display parameters pertaining to the VFD or the load including the following: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of user-selectable parameters.

c. LED lights must be provided. These indications must be visible both on the keypad and on the VFD when the keypad is removed.

d. Two-level password protection must be provided to prevent unauthorized changes to the programming of the VFD.

e. VFD must offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses.

f. A battery back-up must be provided to maintain internal clock operation during power interruptions.

g. Inputs and outputs must be optically isolated.

h. The VFD must have at least two analog signal inputs. Inputs must be programmable for either 0 -10V or 0/4-20 mA.

i. At least one programmable analog output must be provided for indication of the drive status. This output must be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal must be 0/4-20 mA.

j. The VFD must be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

k. The VFD must be equipped with a standard RS-485 serial communications network connection.

7. Adjustments:

a. The VFD must have selectable output switching frequencies to mitigate motor noise.

b. Multiple complete programming parameter setups must be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to program for up to four alternate control scenarios without requiring parameter changes.

c. In each programming setup, independent acceleration and deceleration ramps must be provided. Acceleration and deceleration time must be adjustable over the range from 0 to 3,600 seconds to base speed.

d. The VFD must have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature must offer a Semi-Automatic program to simplify the set-up.

e. VFD must include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

f. The VFD will include a user-selectable Reset function, which enables the selection of between zero and multiple restart attempts after a self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload). The time between restart attempts must be adjustable from 0 through 600 seconds.

g. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

8. Bypass

a. Provide a manual bypass in conjunction with the VFD for the recirculation pump(s) consisting of a door interlocked main pad lockable disconnect in the off position, a built-in motor starter and a facility for allowing DRIVE/OFF/BYPASS/TEST switching by three contactor control.

b. Provide a soft starter for bypass operation for motors of 30 HP and above with Across the Line (ATL) test position.

9. Individual VFD options such as bypass, motor selection contactors, etc. must be incorporated by the manufacturer onto a single panel with a single input feed and main disconnect function. Enclosures must be UL listed and fully assembled by the VFD manufacturer.

10. Service Conditions:

a. The ambient operating temperature of the VFD must be -10ºC to 40ºC (14 to 104°F).

b. Elevation to 3,300 feet (1000 meters) without derating.

c. VFD's must be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% is acceptable.

B. Pump Gauges

1. Pressure gauges must be provided on the discharge of the pumps.

2. Compound gauges must be provided at the intake port of the pumps, after the hair and lint strainer.

3. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

    a. Basis of Design: Gauges must be manufactured by Weksler Instrument Corporation or approved equal.

4. Scale ranges must be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges must be calibrated in psig (0-60 psi) and compound gauge must be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).

5. A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

2.02 FILTRATION EQUIPMENT

A. The filter system must consist of high-rate pressure sand filter tanks as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes operational data and instructions and indicates startup date.

B. It is the intent of these specifications to describe a filtration system complete in every respect with accessory items and supplied and warranted by one manufacturer.

C. Horizontally Oriented Fiberglass Tanks

1. The filter tanks must be horizontally oriented single cell fiberglass tanks, minimum 42 inches in diameter. The filter system must be listed as approved by the National Sanitation Foundation prior to bid date.

    a. Basis of Design: Fiberglass filters must be the product of EKO, Waterco, or Neptune Benson provided they meet the specifications and layout. System design is based upon Neptune Benson. Valves must be provided to backwash one filter at a time.

2. Filter tanks must incorporate components and features as described in this section.

3. Two (2) saddle style bases must be provided for tank support. Systems that incorporate stacked tanks must include similar bases and mounting saddles for the upper vessel. Tank supports and connections must be seismic rated to support the filter tank(s) for the appropriate seismic zone where the project is located. Access to the tank must be provided by a 14" x 18" manhole with two (2) curved yokes. Manhole seal must be complete with a one-piece 1/4" neoprene gasket and positioned so that internal pressure from the filter will augment the seal. No additional hardware or through bolts will be allowed.

4. Each filter tank must be equipped with the necessary flanges and connections for the internal and external piping. Connections must be comprised of fiberglass flanges and schedule 80 PVC flanges.

5. Tank connections 2 inches and smaller must be 150 lb. Type 316L stainless-steel threaded full couplings. Tank connections 3 inches and larger must be heavy steel bosses drilled and tapped on both sides to receive standard flanged fittings or Sch. 40 Type 316L stainless-steel nipples.

6. The discharge from the automatic air release valve must be hard piped to waste. Each filter tank must have a means of releasing air. Each coupling or orifice must be provided with a slotted PVC sand retainer or stainless-steel strainer. An automatic air release system must be provided for each tank.

7. The drain system must consist of a 3/4-inch 316L stainless-steel coupling mounted at the lowest point in the bottom head. This drain must be valved and piped to the nearest floor drain or backwash pit.

8. Filter Piping - Internal

    a. The lower internal distribution system must be a horizontal header/lateral arrangement. The header must be Schedule 80 PVC construction, capped on one end and flanged or threaded at the other end for field connection. Lateral connections must be spaced no more than 6 inches on centers and must be 1-1/2-inch FPT connections. Attachments to header must be solvent welded and thermo-welded to ensure integrity of connection.

    b. Under drain system must be factory installed and constructed of extra heavy Schedule 80 high impact PVC. Multiple PVC main headers must be tapped and threaded to receive laterals.

    c. Laterals must consist of 1-1/2-inch Schedule 80 PVC pipe with openings as required. Each lateral must be fabricated complete with socket cap on one end and male adapter on the other end. Both fittings must be solvent welded to the slotted pipe. Laterals must be designed and sized at the factory, so they are installed in the field and over the entire cross sections area of the filter.

    d. The upper distributor must consist of PVC piping Schedule 80 and/or deflector plate per manufacturer standard design.

    e. Each filter must be supplied with a pressure equalizing upper internal distribution system consisting of a horizontal header/lateral arrangement. The header piping must be constructed of Schedule 80 PVC. The header/lateral piping and connections must be designed and sized to provide uniform distribution and unrestricted flow during the filtration and backwash cycles.

    f. Upper laterals must be constructed of Schedule 80 PVC pipe with machine slotted openings or orifices. Machined slots or orifices must be clean, de-burred and free of obstructions that would not permit the free flow of water through the opening. Details of the lateral attachment to the header must be submitted for review and approval.

    g. The lower and upper distribution systems must be properly supported and anchored. Hardware in wetted areas must be Type 316L stainless-steel or non-

metallic. Tank interiors must be inspected prior to the media being placed in the filters.

9. Filter Piping - External (Face)

   a. External face piping must be Schedule 80 PVC pipe and fittings. Flanges must be located so as to allow for easy dismantling of face piping. Fittings must be solvent cemented.

   b. Piping must be drilled and tapped where necessary to accommodate gauge tubing connectors.

   c. Valves 3" and larger must be constructed with cast aluminum S12A alloy (as defined by ASTM B275) housing and fully coated with Rilsan on interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and 316L stainless-steel shaft. Valves must be rated for 150 psi bubble tight shutoff. Unless otherwise specified, nuts and bolts must be stainless-steel with stainless-steel washers and used when secured to PVC flanges. Systems incorporating solenoid, pneumatic, pressure amplified, hydraulic or multi-directional valves are not acceptable.

   d. Standard accessory items must include sight glass rated for 50 psi with polycarbonate glass, remote mounted gauge panel with two 4½" diameter pressure gauges, ¼" petcocks, ¼" poly vent tubing with PVC compression adapters.

10. Backwash Control

   a. The filter manifold face piping must be designed to allow for one (1) filter tank to backwash at a time while the recirculation system is operating. A semi-automatic backwashing system must be provided with the filter system.

   b. Semi-Automatic Backwashing System

      1) The semi-automatic backwash system must be capable of operating the entire backwash filter sequence for its respective pool with one push of the button.

   c. Water connection to backwash system and booster pump system

      1) A 3/8” minimum protected water connection must be provided to the backwash controller. Coordinate with manufacturer.

      2) A booster pump system (BPS) must be provided by the filter system manufacturer for the purpose of maintaining a consistent, adjustable water pressure for hydraulic actuation of the backwash control valves. The BPS must include a centrifugal pump, pressure sustaining tank, adjustable pressure switch, valves, required tubing / connectors and fittings and appurtenances for a complete and operable system.

11. Automatic Air Relief Valve

   a. A 1” valve must be provided to automatically and continuously release air in the filter. The valve must be fabricated of plastic with Buna-N seals. A plumbing kit must be provided with two (2) PVC ball valves to allow manual air relief and isolation of the automatic valve. Valves fabricated of cast iron, bronze or stainless-steel valves will not be accepted.

12. Filter Media

    a. Filter media must be a carefully selected grade of hard uniformly graded silica material. Media must be milled angular shaped particles of silica quartz. The filter sand must have a particle size between 0.45 mm and 0.55 mm and have a uniformity coefficient not to exceed 1.53. Specific gravity must not be less than 2.5 with a pH of 7.0.

    b. Media (sand) must be cleaned and free from clay or limestone deposits. The bottom layer of support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media.

    c. Media must be delivered after approval by the manufacturer of the filter and stored in 100-pound bags for ease of handling and elimination of possible contamination.

    d. Media must be supplied by the filter manufacturer and approved by the filter manufacturer prior to shipping.

13. Support Media

    a. A Gravel support media of a hard-coarse aggregate with a sub-angular grain shape with a particle size of 1/8" x 1/4" must be used on the inside of the bottom head to the elevation where the filter media commences. The specific gravity must not be less than 2.5. Support media must be placed by hand to avoid damage to the underdrain system and leveled before the addition of the upper layer of filter media. Concrete under fill is not recommended. Support gravel must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

    b. Sand must be a carefully selected grade of hard, uniformly graded silica material. Media must be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand must have a particle size between 0.45mm and 0.55 mm (#20). No more than 1.5% is allowed to pass through a #40 sieve (.0164”). Uniformity coefficient must not exceed 1.53. Specific gravity must be not less than 2.5. The filter must contain a minimum bed depth as recommended by the manufacturer. Systems which do not provide a minimum bed depth will not be accepted. Sand must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

2.03 RECIRCULATION FITTINGS

A. Main drain grate openings must not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.5 fps. The grate must be stainless-steel and fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. The exposed edges of main outlets must be rounded and smooth, free of burrs and sharp edges. Main drain covers must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017. Project specific shop drawings detailing piping port locations and sizes on each side of the main drain sump must be provided for each sump.

2.04 PIPING SYSTEMS

A. General

1. Provide recirculating piping between the pool(s) and the pool mechanical room, fill funnel and all interconnecting piping to and from the chemical feed systems and chemical controller.

2. Provide necessary pipe supports and support systems required to support associated piping and valves.

3. Provide other tubing, conduit or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required and must be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to the nominal inside diameter of the pipe.

2. PVC swimming pool piping must be NSF approved and conform to the requirements of ASTM D-1785.

3. PVC pipes must be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.

4. The swimming pool piping above and below the floor in the pool mechanical room must be Schedule 80 PVC.

5. The influent and effluent lines to the heat source unit must be CPVC. Connections between metallic piping and/or equipment and PVC must be flanged.

6. PVC and CPVC fittings must be the product of one manufacturer. Molded fittings must be manufactured by Ipex, Chemtrol, Harvel, Spears, and Lasco/Westlake or acceptable substitutes. Fabricated fittings must be manufactured by Harrison Machine, Spears, or an acceptable substitute.

7. Vertical sight sump piping must be NSF approved, Schedule 40 PVC. Horizontal sight sump piping must be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and has 3/8” diameter holes located top and bottom on 4 inch or 6-inch centers. Horizontal sight sump piping must extend 1 foot minimum beyond the main drain.

8. Chemical feed lines from chemical feeders to recirculation piping must be Schedule 80 PVC piping. Piping must be hard piped into the recirculation piping via tee or saddle per the drawings. Required valves must be of PVC construction.

9. Flanged plumbing connection hardware must be stainless-steel.

10. Materials must be installed by workmen thoroughly skilled in their trades and work must present a neat and mechanical appearance when complete. At no additional expense to the Owner, replace or correct work not judged acceptable by the Architect, Engineer, or Owner’s representation.

11. Support hardware, brackets, fasteners, hangers, etc. furnished and installed in the surge tank must be 316L stainless-steel.

12. No installation allowed that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.

13. Piping must be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness. Pneumatic (air) pressure test is not allowed.

14. Adhere to the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

15. Mechanical equipment must be connected into the recirculation piping system must be connected utilizing flanged or union connections.

16. Provisions must be made to purge pipes in the system.

17. Concentric reducers must be fiberglass by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction.

C. Pipe Hangers and Supports

1. Manufacturer

a. Subject to compliance with these specifications, pipe hanger and support systems must be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.

2. Hangers

a. Pipes 2 inches and smaller

1) Adjustable steel clevis hanger, B-Line models B3100 or B3104.

2) Adjustable steel swivel ring (band type) hanger, B-Line model B3170.

b. Pipes 2-1/2 inches and larger

1) Adjustable steel clevis hanger, B-Line model B3100.

2) Adjustable steel yoke pipe roll, B-Line model B3114.

3. Multiple or Trapeze Hangers

a. Trapeze hangers must be constructed from 12-gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8-inch minimum, B-Line B22 strut or stronger as required.

b. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B-2000 series.

4. Wall Supports

a. Pipes 2-1/2 inches and smaller

1) Steel offset “J” hook hanger, B-Line model B3600.

b. Pipes 3 inches and larger

1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series.

2) Welded steel bracket B-Line model B3066 or B3067 with roller chair or adjustable steel yoke pipe roll. B-Line model B3120 or B3110.

5. Floor Supports

a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3092 and B3088T or B3090 and B8088. Pipe saddle must be screwed or welded to an appropriate base stand.

6. Vertical Supports

a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.

7. Plastic Pipe Supports

a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, B-Line models B3106 and B3106V, to form a continuous support system for plastic pipes smaller than 1 inch or flexible tubing.

b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

8. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels must be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

D. Hanger Attachments

1. Upper Attachments

a. Beam Clamps

1) Beam clamps must be used where piping must be suspended from building steel. Clamp type must be selected on the basis of load supported and load configuration.

2) C-Clamps must be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps must be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturer's recommendations for set screw torque. Retaining straps must be used to maintain the clamp position on the beam where required.

3) Center load beam clamps must be used where specified. The steel clamps must be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt must be B-Line B3291-B3297 series or approved equal as required to fit beams.

b. Concrete Inserts

1) Cast in place spot concrete inserts must be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts must allow for lateral adjustment and have means for attachment to forms.

Select inserts to suit threaded hanger rods sizes, B-line models N2500 or B3014N series.

2) Continuous concrete inserts must be used where applicable. Channels must be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete, B-Line models B22I, 32I, or 52I or approved equal. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods must be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Hangers must be zinc plated in accordance with ASTM B633 or must have an electro-deposited green epoxy finish.
2. Strut channels must be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or must have an electro-deposited green epoxy finish.
3. Zinc Plated hardware is not acceptable for use in chemical rooms.

G. Valves

1. Valves 3 inches and larger must be butterfly type valves, with PVC body, 150# SWP with stainless-steel shaft, PVC or polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27-inch vacuum to 150 PSI. Extended neck 2 inches beyond flanges for insulated piping must be provided with handle for manual operation. Valve components must be suitable for swimming pool chlorinated water service. Butterfly valves must be Georg Fischer Type 567, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.
2. Valves smaller than 3 inches must be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.
3. Check valves must be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Provide check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves must be Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless-steel spring, Colonial Valve model 601N or 601NP PVC valve with EPDM O-ring and stainless-steel spring or approved equal, for installation between 150 lb. flanges.
4. Butterfly type valves 8 inches and larger must be fitted with a watertight gear operator.
5. Valves located 7 feet or greater off the floor must be fitted with a chain operator.
6. Submerged valves, valves buried below grade, or valves not readily accessible, must be provided with a stainless-steel reach rod and handle.

7. Valve hardware must be 316L stainless-steel and meet ANSI hardware installation guidelines.

H. Pipe and Valve Identification

1. Exposed pool piping must be equipped with color coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. Verify that pool piping identification is in accordance with local and state health regulations.

2. Valves must be identified with minimum 1-1/2-inch diameter plastic laminate engraved tags with minimum 1/2-inch-high numbers. Tags must be fastened to valves with a nylon attachment (zip tie). Valves must be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram that must be prepared.

2.05 CHEMICAL TREATMENT SYSTEMS

A. pH Buffering System (CO_2)

1. Shop drawings complete with a piping diagram depicting the location in which the CO_2 feeder is connected to the system must be provided and approved prior to installation. Installation of the system must be as specified in the manufacturer's directions with no exceptions taken.

2. Bulk Storage

a. Provide a repair for the existing system for storing, regulating, and feeding carbon dioxide for pH control. The system must operate as a newly installed system and consist of CO_2 storage tank(s), a pressure reducing/regulating system, a feed and rate of flow adjustment control system, injection system/mass transfer system, and valves, tubing, fittings, and appurtenances required for a complete and operable system.

b. Basis of Design: The bulk storage tank with remote fill box must be Taylor-Wharton Easy Carb Series or approved equal. The system is to include the following components:

3. Adjustable Rate of Flow Feed Unit(s)

a. Provide an adjustable rate of flow feed unit to control the flow of CO_2 from the storage tank(s) to each pool. The feed unit(s) must be connected to the storage system with thick wall 3/8-inch OD reinforced braided polyethylene tubing enclosed in schedule 40 PVC. The feed system must include 120-volt AC solenoid operated valve for remote on/off control of CO_2. Feed system must be provided by BECS, Prominent, EKO3, or approved equal and as shown on the drawings.

b. Injection System: Provide one (1) system for each body of water; a wet stone diffuser designed for use with CO_2, sized to the pipe in which it must be inserted and for the maximum anticipated rate of CO_2 flow. Provide with pipe saddle connector and fittings and connectors required for a complete and operable installation. The system must be certified per NSF/ANSI Standard 50.

4. CO_2 Alarm & Monitoring System

a. Provide a CO_2 alarm and monitoring system in the locations shown on the drawings. The system must include a hi-res digital display and must allow for communication with four (4) CO_2 infrared sensors and eight (8) alarm units. Sensors and displays

must have an ingress protection rating of IP55 and IP54 respectively. The system must be the AX60+ by Analox or approved equal. The system must be tied into the Building Management System through 4-20mA and Modbus RTU communication.

B. pH Buffering System (Muriatic Acid)

1. Provide one (1) one drum modular spill platform. Platform must be molded high-density polyethylene with removable polyethylene grating. Platform must be 26.25" x 26.25" x 6.5" with a spill capacity of 15 gallons and a load capacity of 2000 pounds. Platform must be an Eagle one drum modular spill platform model #1633 or approved equal.

C. Ultraviolet Dechloramination and Disinfection System

1. Medium Pressure UV

a. Ultraviolet Disinfection Equipment: Must operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection/inactivation of bacteria, algae, molds, viruses, and destruction of Monochloramines, Trichloramines, and Dichloramines. Ultraviolet Lamp/Chamber and Spectra Touch Control Panel by Evoqua Technologies Ltd. or approved equal. Deviations/exceptions must be provided in writing to and approved by the designer prior to the bid date.

1) Ultraviolet disinfection equipment by Aquionics and Prominent are approved equals.

b. The UV System must have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified including Section 14.18 (crypto inactivation) and 3rd party validated to the USEPA UVDGM 2006 Guidelines.

1) Equipment General Description: The Ultraviolet System must be provided in a complete package to include a stainless-steel chamber, Spectra Control System located in NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, automatic wiper system, and Project Commissioning by a Certified Ultraviolet Technician.

c. Wafer (WF) Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Unit must be a medium pressure system with 94% UVT at the indicated design flow rate. Systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet must be as indicated on the drawings.

d. Ultraviolet Lamp

1) Ultraviolet lamp must be medium pressure high intensity. Lamp must be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. The lamp(s) must remain unaffected by temperature variance of 0 degrees F (-17 C) to 200 degrees Fahrenheit (93 degrees Celsius).

2) The lamp system must provide a constant dose of not less than 60 mJ/cm2 until the end of the lamp life for indoor applications and not less than 40

mJ/cm2 for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with infinitely variable power control of the lamp intensity & dose. Power stepping not acceptable. The lamps must be capable of turndown to 30% of the nominal rated power.

3) The lamp must be connected via means of a plug connector and must have a mechanical interlock to prevent lamp removal when lit for safety reasons.

e. Ultraviolet Reactor

1) The unit must be constructed of 316L stainless-steel electropolished and passivated to prevent corrosion within the harsh pool environment.

2) The Ultraviolet chamber must come complete with the following equipment: Ultraviolet intensity monitor factory calibrated to provide intensity in mWcm2, monitors providing percentage of lamp output not acceptable. It must include a built-in alarm system to notify the operator when the output level drops below the required level of 60 mJ/cm2 for indoor pools or 40mJ/cm2 for outdoor pools (or operator set dosing levels).

3) UV Reactor will be a validated system with third party testing to a recognized international standard such as the USEPA DGM.

4) Ultraviolet temperature monitoring system must be provided to maintain system integrity in the event of flow interruptions to the chamber.

5) Ultraviolet chamber must come complete with annealed quartz sleeve with "O" ring seals for water tightness. The system must be complete with advanced seal arrangement to reduce the risk of quartz over-compression on the seal face.

f. Automatic Wiper System

1) An automatic cleaning system must be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system must travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings must be provided to ensure thorough quartz tube cleaning and quartz tube protection. The wiper cycle must be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up.

2) The wiper system must have the following characteristics:

a) The system must utilize direct drive with square faced coupling and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.

b) The wiper power supply must be 24-volt DC for improved safety. Higher voltage not acceptable.

c) System must incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.

d) The wiper interval must be operator selectable with optional override switch.

e) Wiper faults must be indicated on the control system display.

f) Wiper System to utilize “Intelligent Operation” for automatic start-up commissioning.

3) Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.

4) Establish a travel run without using limit switches to ensure system integrity and longevity.

g. UV Strainer

1) The UV system must be provided with a downstream strainer to protect against the possibility of lamp/quartz breakage traveling downstream.

2) Pressure gauges must be provided on each side of the strainer. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer. Pressure ranges must be calibrated in psig (0-60 psi). Basis of Design: Gauges must be manufactured by Weksler Instrument Corporation or approved equal.

3) A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

h. Ultraviolet Control System

1) The control cabinet must be a SPECTRA control unit and or pre-approved equal.

2) The power must be controllable to provide full power, half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. The power panel must house the electronic ballasts required to ignite and power the lamps.

3) Three levels of operation must be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration.

4) Modes of operation must be password protected to secure system critical setup functions. Touch Control system must have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

5) The display must include the following:

a) Ultraviolet calculated dose

b) Ultraviolet intensity (as a percentage and mW/cm^2)

c) Lamp Current

d) Flow rate (as gallons per minute or m^3/hour)

e) Chamber Temperature

f) Operation hour meter

g) Fault indicators to include Lamp fault, low UV & temperature alarm, ground fault trip, wiper fault.

h) Alarm functions must have a simple text message display to assist in fault finding.

i. Ultraviolet Control System Interface

1) The Control system must have a minimum of the following system interface control:

a) Remote operation

b) Process interrupt features (from valves & flow meters)

c) Low UV dose

d) Flow meter input.

e) Auto-Restrike.

f) Half to full power UV setting with 24 hour/7-day settable timer.

g) Variable power/Dose pacing interface

2) Control system must have built in data-logging capabilities to record the following information:

a) UV intensity required.

b) UV intensity measured.

c) Lamp current

d) Chamber Temperature

e) Flow Rate

f) Time and date stamp, every alarm generated.

j. Manufacturers must maintain spare or replacement parts in the USA for the same day or not longer than next day delivery in North America.

D. Electronic Flocculation System

1. The Clear-Flow Electronic Flocculation system must be provided and installed on the recirculation piping for the swimming pool(s). The Clear-Flow system must be a non-chemical water treatment system designed to operate as an electronic flocculant in recreational water systems. When implemented into the system, the Clear-Flow system must work to agglomerate both organic and mineral particulate resulting in filtration enhancement on all types of filtration systems. This filtration enhancement must allow for a reduction in backwashing frequency - saving water, chemicals, and energy.

2. The Clear-Flow system must be UL listed and certified to NSF/ANSI Standard 50 and documentation of such certification must be provided by the manufacturer with each system.

3. When used in a recreational water application, the Clear-Flow system must work as an electronic flocculant. By generating and propagating a low-frequency treatment signal throughout the entire plumbing system, the technology must produce an ongoing flocculation effect which will aid in a reduction in turbidity and improved clarity.

4. The Clear-Flow system's ongoing flocculation effect must enhance filtration efficiency. The flocculation effect must create larger particles allowing for a reduction in both frequency and duration of backwashing.

5. Equipment

    a. The following components are contained in a standard Clear-Flow kit and must be provided for each system:

        1) ABS or SS enclosure with 3 glands (2 for signal leads and 1 for power supply)

        2) Signal cables complete with mounting tags (Temp. rating -40°F to +140°F) (Qty. 2)

        3) Stainless steel hose clamps (Qty. 4)

        4) Gland plug (Qty. 1)

        5) 2A / 250 VAC UL-listed slow blow fuse (Qty. 1)

        6) 4mm Allen wrench (for grub screw) (Qty. 1)

6. Clear-Flow electronic flocculation system models must be the following:

    a. For 4" pipes: Model # CF-400

    b. For 6" pipes: Model # CF-600

    c. For 8" pipes: Model # CF-800

    d. For 10" pipes: Model # CF-1000

    e. For 12 pipes: Model # CF-1200

7. Power Requirements:

    a. Input Voltage: 100–240 VAC

    b. Input Frequency: 50 - 60 Hz

    c. Power Rating: 4W for CF-300C, 5.4W for all other models

    d. Internal Fuse Rating: 2A / 250VAC UL-Listed slow-blow

    e. Temperature Range: -40°F to +140°F

    f. The electrical supply must be properly grounded, or the system will not work. Hard wiring is preferred to avoid accidentally unplugging the unit.

    g. All safety-critical components must conform to relevant CE/IEC/UL 60950. E235235. Terminals, wires, fuse, on/off switch, AC/DC PSU. PSU must be Class II protected.

    h. Armored 2 Core Cable:

1) Spec. BC 6883; 1999

2) IEC 600332 –3—22 Category A

3) Temperature rating - 22°F to +140°F

4) ISO 9001 – 2008 Approved

8. Installation

   a. To ensure proper start-up of equipment the Contractor must consult a Clear-Flow representative.

   b. Optimal results are achieved if the Clear-Flow system is connected to a grounded power outlet (100-240 VAC, 50-60 Hz, 4-amp) that shares the same ground as the recirculation system the unit is being installed on.

   c. The Clear-Flow system must come with two identical signal cables. One is intended as the "T" (transmit) signal connection, the other is intended as the "A" (antenna) signal connection. The "T" signal tag must be installed downstream from the pump and before the filter. It is preferred that the "T" signal tag is mounted on a metal reducer or stainless-steel spool piece downstream of the pump. Alternative installation points for the "T" signal tag can be to mount it on a metal valve, the downstream flange of the pump (if metallic), or a stainless-steel spool piece that would provide a metal-to-water path for the treatment signal to propagate into and throughout the pool's recirculation system. The "A" tag must be mounted on a metal structure that is electrically connected to the system loop, which may include but is not limited to a grounded filter, nearby structure, or ground rod.

   d. The Contractor must provide a stainless-steel spool piece matching the main recirculation header pipe size installed between flanges downstream of the recirculation pump(s) and upstream of the filters to facilitate installation of the "T" signal tag per manufacturer requirements. Coating must be 3M Scotchkote 134 fusion bonded epoxy, or approved equivalent on the complete interior of fitting.

   e. The maximum cable run length from the control cabinet (typically wall mounted) to the "T" signal tag installed on the pool recirculation pipe must be 33 feet. Installation locations must be coordinated to meet this parameter.

9. The Clear-Flow system unit must be rated for -40º F + 140º F ambient operation. The unit must have no ventilation requirements and be able to be used indoors and outdoors.

10. After identifying the proper installation location for the "T" tag, the Contractor must prepare the point for strong electrical contact with the tag. The Contractor must remove any epoxy or enamel coating which may inhibit a strong connection. The Contractor to make output connections per wiring schematic. Connect "T" and "A" connections into the labeled terminals inside the enclosure.

11. The Contractor must confirm Clear-Flow system is functioning properly and operating under the following conditions. After powering on the unit, consult the LCD screen to determine the frequency and amperage output.

    a. The optimal frequency range is between 100-350 kHz.

    b. Optimal amperage is between 1 and 5 amps.

c. If frequency and amperage are outside of these ranges, the Contractor must adjust capacitor switches on the upper right side inside the enclosure.

d. If current amperage is not achievable under 5 amps after making capacitor adjustments, the Contractor must disconnect “A” tag from inside the terminal block and repeat adjustment of capacitors.

e. If these steps do not result in an optimal sine wave within the recommended frequency and amperage, the Contractor must consult a Clear-Flow Representative.

f. As an additional means of signal verification, an oscilloscope can be used. By touching the oscilloscope probe onto the pipe near where the “T” tag is connected, signal strength and frequency can be measured. A clean, declining sine wave with minimal harmonics should be observed.

12. The Contractor must cut excess signal cable, but not to less than 10 feet (3 meters) in length. The Contractor must not coil power cord or signal cables; doing so will interfere with signal operation.

13. The Clear-Flow system must be powered on/off via a switch on the enclosure.

14. Replacement fuses must be UL-listed.

15. The complete installation must be by the manufacturer’s installation instructions and certified on-site for proper operation by the manufacturer’s representative for each system installation.

16. The Clear-Flow system requires that the electrical supply be properly grounded. The Contractor must follow Institute of Electrical and Electronics Engineers (IEEE) standards ensuring a ground resistance of 5 ohms or less.

2.06 FLOW METERS

A. Recirculation flow meter must be provided according to the manufacturer in the filtered water return lines for the pool(s) as indicated on the drawings. The flow sensor must be the GF Signet 2551 insertion magmeter. Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy must be +/- 2% of reading.

B. Impact flow meter must be provided as indicated on the drawings. Impact flow meter must be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale must be permanently etched or imprinted on the meter. Flow rate indicator must be of stainless-steel material. The scale range must be appropriate for a specific flow rate. Pipe size to accommodate backwash rate. The backwash piping flow meter must be BLUE-WHITE series F-300 or approved equal.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

A. Carefully examine the contract documents for requirements that affect the work of this section. Prior to starting work, notify the Architect of defects requiring correction. Do not start work until conditions are satisfactory.

B. Verify that work by others, related to this section, has been completed. This includes earthwork, concrete work, and mechanical, electrical, and plumbing connections.

C. Protect materials and work completed by others from damage while completing the work in this section.

3.02 FIELD MEASUREMENTS

A. Verify benchmark and pool equipment location prior to layout.

B. If field measurements differ from the construction drawing dimensions, notification must be given to the Architect prior to proceeding with work.

3.03 PIPING INSTALLATION

A. General

1. Provide and erect, according to the best practices of the trade, piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings must be considered as diagrammatic in indicating the general run and connections and may or may not in parts be shown in its true position. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of piping, it must be properly supported, and proper provisions must be made for expansion, contraction and anchoring of piping. Piping must be cut accurately for fabrication to measurements established at the construction site. Pipe must be worked into place without springing and/or forcing, properly clearing windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. Pipes must have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. Changes in direction must be made with fittings. Open ends of pipes and equipment must be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. Piping must be arranged so as not to interfere with removal and maintenance of equipment, filters, or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions applicable for the type of piping specified must be provided in the piping at connections to items of equipment. Piping must be installed to ensure noiseless circulation. Valves and specialties must be so placed to permit easy operation and access.

B. Pipe Hangers and Supports

1. Pipes must be adequately supported by pipe hangers and supports as specified.

2. Horizontal PVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
1-1/4" and less	5'-0"	3/8"
1-1/2" to 3"	6'-0"	1/2"
4" to 6"	8'-0"	5/8"
8" to 12"	10'-0"	7/8"
Greater than 12"	12'-0"	1"

3. Horizontal CPVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
½" and less *	4'-0"	3/8"
¾" to 2"	6'-0"	3/8"
2-1/2" to 3"	7'-0"	1/2"
4" to 8"	8'-0"	7/8"
Greater than 12"	10'-0"	1"

4. Round rods supporting the pipe hangers must be of the following dimensions:

Nominal Pipe Size	Rod Diameter
1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

5. Hanger rods must be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.

6. Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.

7. Provide hangers to provide a minimum of 1-inch space between finished covering and adjacent work.

8. Place a hanger within 12 inches of each horizontal elbow.

9. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

10. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified. Trapeze hangers must be spaced according to the smallest pipe size or provide intermediate supports according to the support spacing schedules. Provide heavier members as required for the load supported for the entire span distance. Hanger rods must be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

11. Piping must be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify the building structure for hanger installation.

12. Attachment of piping hangers to the building structure must be provided in a manner approved by the Architect. Provide concrete inserts installed by others in the building construction at the time the concrete is poured, and hangers must be attached to these inserts.

13. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

14. A design for piping in a service tunnel, if required, supported by a structure must be submitted for approval. The structure must be non-corrodible and must be of a size and configuration to rigidly support the piping as shown in the plans at a minimum spacing as shown below.

C. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Where concrete slabs form finished ceilings, inserts must be flush with the slab surface.

4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Flushing, Draining and Cleaning Pipe Systems

1. Flush out water systems with water before placing them in operation. Other systems must be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, strainer screens must be removed and thoroughly cleaned.

E. Expansion and Contraction

1. Make necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections, and anchors as required to prevent undue strain. Provide shop drawings for method and arrangement for control of expansion and contraction of piping.

F. Testing

1. Piping installation and pressure testing must be performed by the Contractor and reviewed by the Owner or a designated representative of the Owner before commencement of backfilling. A minimum one (1) week notice must be provided prior to review. Results must be submitted to the Architect. Pictures with time stamps for each section of piping must be included with testing report(s) and be submitted within one (1) week of the pressure test(s).

2. Suction and supply pool piping must be capped and hydraulically pressure tested with water to a pressure of not less than 50 PSI for a period of no less than two (2) hours. Pressure testing must be conducted in accordance with ASTM D2774. The temperature of the water used for the test must be between 40ºF and 90 ºF.

3. Gravity pool piping must be capped and hydraulically pressure tested with water to a pressure of not less than 20 PSI for a period of no less than two (2) hours. Pressure testing must be conducted in accordance with ASTM D2774. The temperature of the water used for the test must be between 40ºF and 90 ºF.

4. Pneumatic testing (air) of any pool piping will not be accepted.

5. The Contractor must verify recirculation fitting pressure limitations can meet testing requirements prior to installation and testing. Piping may be tested prior to a recirculation fitting connection (skimmer, main drain, etc.) within 5’-0” of connection point.

6. Maintain a sustained 20 PSI pressure on pool related piping throughout the course of construction.

7. Adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

3.04 EQUIPMENT AND SYSTEMS INSTALLATION

A. Provide and assemble equipment, special parts and accessories as shown on pool drawings, specifications, and shop drawings of the equipment suppliers.

B. Provide anchors and inserts imbedded in the deck including fittings, inserts and structure sleeves and required anchorage as shown on the plans and as indicated in this section of the specifications. Equipment must be set true and plumb, using factory jigs where available. Removable equipment items must be easily removable from anchors and must fit without noticeable wobble.

C. Provide templates for equipment anchors. Provide anchor bolts of the size and spacing as required by the equipment manufacturer. Anchor bolts must be stainless-steel Type 316L and of a length capable of adequate anchorage into rough slab-on-grade allowing for finish deck tile and setting bed. Anchors must be set and cast into place during building concrete work. Inspect anchor settings for horizontal and vertical alignment prior to placing concrete.

D. Provide equipment and systems in accordance with manufacturer's directions. Equipment must be assembled and in place for final observation.

E. Items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. Make provisions accordingly and submit shop drawings and submittals based on that data.

3.05 START-UP AND INSTRUCTION

A. Supply the services of an experienced swimming pool operator/instructor for a period of not less than two days (total 16 hours) after the pool(s) have been filled and initially placed in operation. During this period, the Owner's representatives who will be operating the pool(s) must be thoroughly instructed in phases of the pool's operation. Deliver six (6) complete sets of operating and maintenance instructions for the swimming pool, structures, finishes and component equipment. Prior to leaving the job, obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and necessary operating information provided. Include the cost of two (2) additional days (total 16 hours) of instruction and operational check out by the qualified representative during the first season of operation.

B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments must be submitted to the Owner and Architect/Engineer within one (1) week after each visit.

C. Provide specific written procedures that must be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION

SECTION 20 01 23

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

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 items such as filling the systems to make them operable, including water, refrigerant, oil and grease. Also included is start-up and testing which includes both new (Contractor or Owner furnished) or existing equipment affected by the work. This also includes seasonally affected systems, which may require a scheduled visit to the project after substantial completion, once weather permits proper operating conditions (e.g. evaporative coolers, boilers, etc.) Prove satisfactory operation of all equipment and controls to the Engineer on request.

1.02 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 22 & 23 work.

B. INDEX – (BREAKDOWN OF SECTIONS)

PART 1. GENERAL

Scope of Work
Section Includes
Index
Related Documents
General Qualifications and Guidelines
- Contractor Responsibilities
- Existing Utilities
- Insurance
- Conflicts and Correction

Definitions
Permits, Utility Connections and Inspections
Qualifications
Qualification Procedures
Guarantee – Warranty
Contract Documents
Work Sequence

Submittals and Fabrication Drawings – Substitutions and Procedures
- Submittals
- Fabrication Shop Drawings

Substitutions
Products, Materials and Workmanship
Regulatory Requirements
General Materials and Equipment Requirements
Wall, Floor and Ceiling Plates
Sleeves, Inserts and Fastenings
Electrical Arrangement of Motors and Equipment
Project Site Conditions
Cooperation Between Trades and with Other Contractors
Supervision
Site Observation
Precedence of Materials
Records for Owner
Altitude Ratings
Roof/Equipment Interface
Fire and Smoke Rating Requirements

PART 2 – PRODUCTS – Not Used.

PART 3 – EXECUTION

Pipe Pressure Tests
Concrete Bases And Housekeeping Pads
Alignment Of Flexible Couplings
Manufacturer's Recommendations
Space And Equipment Arrangement
Large Apparatus
Protection
Installing Methods
Cutting And Patching
Excavation, Trenching And Backfill
Access Doors
Operation Prior To Completion
Cooperation And Clean Up
Clean And Painting
Tests
Log Of Tests
Start-Up And Training
Operation And Maintenance Data

1.03 RELATED DOCUMENTS

A. Related Sections – Coordinate the requirements of this specification with requirements in other sections. See other sections including:

B. Specification Sections for Cutting and Patching.

C. Specification Sections for Shop Drawings, Product Data, and Samples.

D. Specification Sections for Storage and Protection.

E. Specification Sections for Product Options and Substitutions.

F. Specification Sections for Project Record Documents.

G. Specification Sections for Utilities Excavating and Backfilling.

H. Specification Sections for Concrete.

I. Specification Sections for Rough Carpentry.

J. Specification Sections for Flashing and Sheet Metal.

K. Specification Sections for Painting.

L. Specification Sections for Electrical.

M. All work covered by this Section shall be accomplished in accordance with all applicable provisions of the Contract Documents and any addenda or directives which may be issued herewith, or otherwise.

N All work covered by this section shall be accomplished in accordance with all applicable codes. The Contractor will be expected to be familiar with the codes in addition to practices and workmanship standard to the industry.

1.04 GENERAL QUALIFICATIONS AND GUIDELINES

A. The Contractor shall be skilled in his trade. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings. Contractor's requirements should be considered performance based in addition to the prescriptive requirements of these specifications. It is the general intent that a complete and fully operational system be provided. The Contractor's bid for the work shall carry the intent that all systems are furnished complete and operational unless specifically indicated otherwise.

B. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide a neat, integrated, satisfactory, complete and operating installation.

C. The Mechanical, Electrical, and associated Drawings are necessarily diagrammatic by their

nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of code, industry standard practice and workmanship, structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted. Exposed work in occupied areas shall carry an emphasis on appearance and shall include paint, escutcheons, chrome (or other detail materials), and any other such finish work standard to the industry or otherwise indicated.

D. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas with access provided where required for proper operation of the system. See the section titled “Contract Documents” for further information on this topic.

E. Existing Utilities –

1. 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 during construction, which are not shown on the drawings, they shall ask 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.

2. Contractor shall verify location, size, elevation, pressure and any other pertinent data of the existing utilities. 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.

3. All costs associated with providing utilities including, but not limited to, connection fees, 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.

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

5. The Contractor shall coordinate with Owner’s Facility Management, Architect, and this Engineer’s office any work that has the potential to hinder mechanical and plumbing services to areas inside or 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's Facility Management, 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 seven days before commencing work. Owner's Facility Management, Architect, and this Engineer's office shall review these schedules and notify the Contractor of acceptance prior to commencement of work.

F. Insurance –

1. 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.

G. Conflicts and Correction –

1. 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.

2. 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.

3. If a conflict is discovered during construction, the Contractor shall stop work on 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 Engineer's guidance for clarification.

1.05 DEFINITIONS (Note: These definitions are included here to clarify the direction and intention of this specification. The list given here is not by any means complete. For further clarification as required, Contractor shall contact the designated Owner's representative.)

A. Concealed/Exposed – Concealed areas are those areas, which cannot be seen by the building occupants. Exposed areas are all areas, which are exposed to view by the building occupants, including under counters, inside cabinets and closets, plus all mechanical rooms. All systems, whether concealed or exposed shall be provided with access as required for proper operation of the system.

B. General Requirements – Provisions of requirements in Division 1 as well as other sections,

which apply, to the entire work of the Contract and/or project. Basic Contract definitions are included in the General Conditions.

C. Indicated – The term “indicated” is a cross reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements on Contract documents. Where terms such as “shown”, “noted”, “scheduled”, and “specified” are used in lieu of “indicated”, it is for the purpose of helping reader locate the cross reference, and no limitation of location is intended except as specifically noted.

D. Directed, requested, etc. – Where not otherwise explained, terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, “accepted, and “permitted” mean directed by Architect/Engineer”, “requested by Architect/Engineer” and similar phrases. However, no such implied meaning will be interpreted to extend Architect’s/Engineer’s responsibility into Contractor’s area of construction supervision and job safety.

E. And/Or – Where “and/or” is used in these Specifications or on the Drawings, it shall mean “that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit on option on the part of the Contractor.

F. Approve – Where used in conjunction with Architect’s/Engineer’s response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term “approved” will be held to limitations to Architect’s/Engineer’s responsibilities and duties as specified in General and Supplementary Conditions. In no case will “approval” by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract documents or to extend Architect’s/Engineer’s responsibility into Contractor’s area of construction supervision and job safety.

G. As required – Where “as required” is used in these Specifications or on the drawings, it shall mean “that situations exist that are not necessarily described in detail or indicated, that may cause the Contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result. The term shall also carry the general requirement that work be performed with good workmanship and that it result in a complete and operational system.

H. Furnish – The term “furnish” is used to mean “supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.”

I. Where “furnish” applies to work for which the installation is not otherwise specified, “furnish” in such case shall mean, “furnish and install”.

J. Install – The term “install” is used to describe operations at project site including “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operation.”

K. Provide – The term “provide” means “ to furnish and install, complete and ready for intended use”.

1.06 PERMITS, UTILITY CONNECTIONS AND INSPECTIONS

A. Fees and Costs: If, during the course of the construction, a need arises to buy utilities, the Contractor shall pay all fees attendant thereto. If City/County or privately owned utility piping or electrical cable needs to be extended, relocated, or terminated, the Contractor will pay all permits and construction/inspection fees associated with that particular work. The Contractor shall remove and properly dispose of all construction waste.

B. Compliance: The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company, and any other authorities having jurisdiction. In no case does this relieve the Contractor of the responsibility of complying with these Specifications and Drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the Specifications and Drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

1.07 QUALIFICATIONS

A. All mechanics shall be skilled in their respective trade.

B. All welders shall be certified in accordance with the ASME Boiler Test Code, Section IX, latest issue, Certified 6G welders.

1.08 QUALIFICATION PROCEDURES

A. The storage, handling, and transportation of all refrigerants, oils, lubricants, etc. shall be accomplished in strict compliance with all State, local, and Federal Regulations including all requirements set forth by the Environmental Protection Agency (EPA) for the safe handling of regulated refrigerants and materials. The Contractor shall utilize qualified and/or certified personnel and equipment as prescribed by these requirements. In no situation shall any refrigerant be discharged to the atmosphere.

1.09 GUARANTEE – WARRANTY

A. The following guarantee is a part of the specifications and shall be binding on the Contractor.

B. “The Contractor guarantees that this installation is free from mechanical defects. He agrees to replace or repair to the satisfaction of the Architect/Engineer any part of the installation that may fail within a period of one year after date established below, provided that such failure is due to defects in the materials or workmanship or failure to follow the specifications and drawings. Warranty of the Contractor-furnished equipment or systems

shall begin on the date of substantial completion."

C. The extent of guarantees or warranties by Equipment and/or Materials Manufacturers shall not diminish the requirements of the Contractor's guarantee-warranty to the Owner.

1.10 CONTRACT DOCUMENTS

A. All dimensional information related to new structures shall be taken from the appropriate Drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

B. The interrelation of the Specifications, the Drawings, and the schedules are as follows: The Specifications determine the nature and setting of the various materials, the Drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics. If the Contractor requires additional clarification, he shall request it in writing, following the contractually prescribed information flow requirements.

C. Should the Drawings or Specifications conflict within themselves or with each other, the better quality, or greater size or quantity of work or materials shall be performed or furnished.

D. Capacities of equipment furnished may exceed those specified as long as there is no detriment to the project as deemed by the Engineer (e.g. short cycling, exceeding electrical limits). There is no tolerance for shortage of capacity. Equipment must at least meet 100% of the design condition.

1.11 WORK SEQUENCE

A. Install work during the construction period. Coordinate mechanical schedule and operations with the Owner and Architect/Engineer:

1.12 SUBMITTALS AND SHOP DRAWINGS – Substitutions and Procedures

A. General

1. Products Submittal List: Include Products specified in the following Sections as well as all equipment listed on the equipment schedules:

a. Specification Section for Piping

b. Specification Section for Supports and Anchors

c. Specification Section for Mechanical Identification

d. Specification Section for Plumbing Piping

e. Specification Section for Ductwork

f. Specification Section for Ductwork Accessories

B. Submittals

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

2. Mark dimensions and values in units to match those specified. Highlight and provide drawing and specification references for all features and values. Inapplicable features shall be crossed out.

3. Submittals shall be grouped and submitted in a three ring binder in a manner where all project submittals can be kept under one cover. Supplemental submittal information shall be marked and dated for coordination with the original submittal, including Engineer's comments and referencing.

C. Fabrication Shop Drawings

1. Submit Shop Drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the Drawings. Rearrangement of equipment as laid out, will only be considered as a last resort. Submitting on equipment that does not properly fit is cause for rejection. Requests to rearrange must be forwarded to the Engineer before submitting. The Contractor shall provide detailed drawings of any space approved for rearrangement, (2) where tight spaces require extreme coordination between ductwork, piping, conduit, and other equipment, (3) where called for elsewhere in these Specifications; and (4) where specifically requested by the Architect/Engineer. Fabrication Drawings shall be made at no additional charge to the Owner or the Architect/Engineer. Shop drawings shall be required for duct, piping, structural and architectural coordination at all air handling unit locations to indicate all runs to and from these units. Shop drawings shall also be required for piping layout in the mechanical rooms.

2. Eight (unless otherwise indicated) complete sets of coordination drawings shall be submitted to the Architect/Engineer prior to the scheduled start of the work in the area illustrated by the drawings, for the purpose of showing the Contractor's planned method of installation. The objectives of such drawings are to promote carefully planned work sequence and proper coordination, in order to assure the expeditious solutions of problems, and the installation of lines and equipment as contemplated by the Contract documents while avoiding or minimizing additional costs to the Contractor and to the Owner.

3. In the event the Contractor, in coordinating the various installations and in planning the method of installation, finds a conflict in location or elevation of any of the mechanical systems, with the structural items or with other construction items, such conflicts shall immediately be brought to the attention of the Architect/Engineer.

1.13 SUBSTITUTIONS

A. General – Within thirty days after the date of Contract award or work order, whichever is later, and before purchasing or starting installation of materials or equipment, the Contractor shall submit for review, a complete list of suppliers, contractors and manufacturers for all materials and equipment which will be submitted for incorporation into the project. The list shall be arranged in accordance with the organization of the Specifications. This initial list shall include the manufacturer's name and type or catalog number as required to identify the quality of material or equipment proposed. This list will be reviewed by the Engineer and the Owner and will be returned to the Contractor with comments as to which items are acceptable without further submittal data and which items will require detailed submittal data for further review and subsequent approval. The initial list shall be submitted as herein specified. Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of these Specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all inapplicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished and key specified features shall be highlighted.

B. It is not the intent of the Drawings and/or Specifications to limit products to any particular manufacturer (unless specifically indicated to have "no equivalents") nor to discriminate against an "approved equal" product as produced by another manufacturer. Specific manufacturer's products are mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. When a manufacturer's name appears in these Specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. Nor should the named manufacturer infer that he is exempt from any specified requirement. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s) and shall also be held to the reasonable standard of the specified manufacturer's product.

C. The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the designer is final.

D. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.

E. Timeliness – The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of two (2) weeks time frame for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor

and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.

F. All equipment installed on this project shall have local representation; local factory authorized service, and a local stock of repair parts.

G. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the Contract documents and that adequate and acceptable clearance for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the Specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

H. Should a substitution be accepted, and should the substitute material prove defective, 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.

I. If a proposed substitution has been rejected a third time, it will no longer be considered. Further considerations on the equipment item shall be with the specified item or pre-approved equal.

J. If a substitute product is used, the contractor shall coordinate with other trades any applicable discrepancies between the substituted product and the designed equipment, i.e. voltage, amps, electric phase, wire size, breaker size, etc. It will be the contractors' responsibility to provide and describe any such differences during submittal review period so that engineer can make necessary changes to plans to account for such discrepancies. If the substituted product is used and no such changes are noted by the contractor and/or addressed during submittal review it will be the contractors sole financial responsibility to correct any necessary field changes.

1.14 PRODUCTS, MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site but shall be replaced with new materials and/or equipment.

B. The responsibility for the furnishing of the proper equipment and/or material and seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation. The Contractor shall not begin work on any item

without a work plan that includes a scheme for a complete and operational system.

C. Flame Spread Properties Of Materials – Materials and adhesives incorporated in this project shall conform to NFPA Standard 255 (1984), "Method of Test of Surface Burning Characteristics of Building Materials". The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

1.15 REGULATORY REQUIREMENTS

The following agencies of jurisdiction, codes, standards, and industry specifications should be considered integral parts of the project documents. The Contractor will be expected to be familiar with and to adhere to the requirements of this information.

A. It is required that the installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these Specifications. All referenced codes and standards shall be those current at the date of issue of the design documents.

B. National Fire Protection Association Standards (NFPA) –

1. NFPA No. 54, Gas Appliances, Piping, National Fuel Gas Code.

2. NFPA No. 70, National Electrical Code.

3. NFPA No. 101, Life Safety Code.

4. NFPA No. 258, Standard Research Test Method for Determining Smoke Generation of Solid Materials.

C. American National Standards Institute (ANSI) –

1. A40.8, National Plumbing Code.

2. B31.1, Power Piping.

3. B9.1, Safety Code for Mechanical Refrigeration.

D. American Gas Association Publications (AGA) – Directory of Approved Gas Appliances and Tested Accessories.

E. Air Conditioning and Refrigeration Institute Standards (ARI) – All standards related to refrigeration and air conditioning equipment and piping furnished under these Specifications.

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) – All current editions of applicable manuals and standards (See Sections 15890 and 15910).

G. Air Moving and Conditioning Association (AMCA) – All current editions of applicable

manuals and standards.

H. American Society of Testing Materials (ASTM) – All current editions of applicable manuals and standards.

I. National Electrical Manufacturer's Association (NEMA) – All current editions of applicable manuals and standards.

J. State of New Mexico Fire Marshalls Office as may be applicable to construction on this site.

K. 2021 New Mexico Commercial Building Code (included the 2021 International Building Code).

L. 2021 New Mexico Mechanical Code and Plumbing Code (include the '21 NM Mechanical and '21 NM Plumbing Codes).

M. Occupational Safety and Health Act (OSHA).

N. ADA and ANSI Standards – All work shall be in accord with all regulations and requirements of the Standards and Specifications for Handicapped and Disabled for the Construction of Public Buildings and Facilities in the State of NM usable by Physically Handicapped and Disabled persons, ANSI Standards and the requirements of the American Disabilities Act.

N. Underwriter's Laboratory, Inc. (UL)

P. Environmental Protection Agency (EPA)

Q. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

R. Refer to Specification Sections hereinafter bound for additional Codes and Standards.

S. All materials and workmanship shall comply with all applicable State and National codes, Specifications, and industry standards. In all cases where Underwriters' Laboratories, Inc. have established standards for a particular type material, such material shall comply with these standards. Evidence of compliance shall be the UL "label" or "listing" under Re-Examination Service.

T. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Architect/Engineer in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 1 of these Contract Documents, providing no work of fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.16 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Storage at Site: The Contractor shall not receive material or equipment at the job site until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

B. Capacities shall be not less than those indicated, but shall otherwise be such that no component or system becomes inoperative or is damaged because of startup or other overload or underload conditions.

C. Conformance with Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters' Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, or any similar listing or testing requirement, the Contractor shall submit proof that the items furnished under this Section of the Specifications conform to such requirements. For example, the label of the Underwriters Laboratories, Inc., applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

D. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

E. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating. The treatment shall withstand 200 hours in salt spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8" on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified except that coal tar or asphalt type coating will not be acceptable unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

F. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts shall be fully enclosed or properly guarded for personnel protection.

G. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and become thoroughly familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect/Engineer of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or the Architect/Engineer.

1.17 WALL, FLOOR AND CEILING PLATES

A. See Specification Section for Supports and Anchors

1.18 SLEEVES, INSERTS, AND FASTENINGS

A. See Specification Section for Supports and Anchors

1.19 ELECTRICAL ARRANGEMENT OF MOTORS AND EQUIPMENT

A. The Contractor shall note that the electrical design and Drawings are based on the equipment scheduled and indicated on the Drawings, and should any mechanical equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

B The Electrical Trades shall provide all interconnecting wiring for the installation of all power to equipment. By code, all equipment must be served and protected by proper electrical equipment such as disconnect switches and starters. Further, it is the intent of the design that all equipment be served and protected in a manner that meets code. All combination starters, individual starters, disconnect switches and other motor starting and safety apparatus not specifically scheduled or specified as provided by the equipment manufacturer under the scope of Division 23, or otherwise indicated under the scope of Division 26, shall be implied to be furnished with these components under Division 23.

1.20 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. Notify the Architect/Engineer if site conditions indicate that locations should be changed.

B. In the event that changes are necessary, prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. See section on fabrication shop drawings for additional requirements on this item. Obtain permission of Owner before proceeding.

1.21 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. The Contractor shall be familiar with and responsible for mechanical requirements that may appear throughout the entirety of the specifications and drawings. Each trade, subcontractor, and/or Contractor must work in harmony with the various other trades, subcontractors and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

1.22 SUPERVISION

A. Each Contractor and subcontractor shall keep a competent superintendent or foreman on

the job at all times. Only licensed master, journeyman and helpers shall be allowed to perform the work.

B. It shall be the responsibility of each superintendent to study all Drawings and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the superintendents involved. Where interferences cannot be resolved without major changes to the Drawings, the matter shall be referred to the A/E for ruling.

1.23 SITE OBSERVATION

A Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Contract Documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed, or as being a safe practice or place.

1.24 RECORDS FOR OWNER

A. The Contractor shall maintain a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Daily note all changes made in these Drawings in connection with the final installation including exact dimensioned locations of all new underground utilities, services and systems and all uncovered existing active and inactive piping outside the building.

B. At Contract completion the Contractor shall provide a set of reproducible drawings. The Contractor shall transfer the information from the "blueline" prints maintained as described above, and turn over this neatly marked set of reproducible Drawings representing the "as installed" work to the Architect/Engineers for verification and subsequent transmittal to the Owner. These Drawings shall include as a minimum:

1. Addendum written drawing changes.

2. Addendum supplementary drawings.

3. Accurate, dimensioned locations of all underground utilities, services and systems.

4 Identification of equipment work shown on Alternates as to whether alternates were accepted and work actually installed.

5. Change Order written Drawing changes.

6. Change Order supplementary Drawings.

C. In addition to the above, the Contractor shall accumulate during the progress of the job, 3 copies of the following data, prepared in a neat brochure or packet folder and turned over to the Architect/Engineer for review, and subsequent delivery to the Owner.

1. All warranties, guarantees, and manufacturer's directions on equipment and material covered by the Contract.

2. Four (4) sets of operating and maintenance instructions for heating and cooling and other mechanical and electrical systems. Instructions shall also include recommended preventative maintenance and seasonal changeover procedures.

3. Valve tag charts and diagrams specified herein.

4. Control diagrams representing "as installed" conditions.

5. Certifications of tests such as piping system pressure tests, backflow prevention certification and required factory testing of equipment.

6. Copies of approved Shop Drawings.

7. Any and all other data and/or Drawings required as submittals during construction.

8. Repair parts list of all major items and equipment including name, address and telephone number of local supplier or agent.

9. Testing and Balancing Report.

10. "As-Built Drawings."

11. Documentation on Start-up and Training.

D. All of the above data shall be submitted to the Architect/Engineer for approval, and shall be corrected as instructed by the Architect/Engineer before submission of the final request for payment.

1.25 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in service maintenance of all plumbing, heating, air conditioning, and ventilating services for the existing facility. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light

fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.26 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items, which are to be relocated, shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities, which must remain in operation during the construction period, shall not be interrupted

without prior specific approval of the Owner as hereinbefore specified.

1.27 ALTITUDE RATINGS

A. Unless otherwise noted, all specified equipment capacities are for actual site altitude above sea level and adjustments to manufacturer's ratings must be made accordingly.

1.28 ROOF/EQUIPMENT INTERFACE

A. Piping – Penetration shall be accomplished with factory-made assemblies designed specifically for the purpose. The use of pitch pans or pitch pockets is not allowed.

B. Ductwork without Equipment – Unless otherwise indicated, penetration shall be accomplished with a factory-made insulated roof curb designed for use as duct penetration through roof.

C. Ductwork with Equipment – Each piece of roof mounted equipment such as packaged rooftop air conditioners, air handlers, shall be provided and installed with an insulated roof curb designed to mate with the equipment and provide a weatherproof enclosure. In the event that pre-insulated curb is not available, an un-insulated curb is acceptable if the Contractor provides and installs field insulation per the manufacturer's instructions. Contractor shall coordinate the roof curb(s) with the Roofing Contractor for installation.

D. General – All roof flashing assemblies, equipment supports and roof curbs shall be closely coordinated with other work through the Roofing Contractor to insure that the flashing, canting, insulation type, installation and location, etc., is correct and appropriate for the particular roof construction type.

E. Each 18" roof curb shall be selected and provided so that the top of the curb shall be level after installation. The curb shall provide a minimum clearance of 12 inches between the top of the finished roof surface and the top of the wood nailer, continuous around the curb perimeter unless noted otherwise.

F. Each roof penetration location shown on the drawing is approximate. Refer to the Architectural and Structural drawing for the structural openings. Refer to cutting and patching section of this Specification for more information.

G. Provide each roof curb with other options as scheduled on the drawings.

1.29 FIRE AND SMOKE RATING REQUIREMENTS

A. The Contractor shall review and become familiar with all the project documents as they pertain to fire and smoke rating requirements.

B. 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.

C. Contractor shall verify locations and type of all partition penetrations from the drawings. Sealing material and methods shall be per UL recommendations.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION

3.01 MANUFACTURER'S RECOMMENDATIONS

A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, piping, wiring, start-up, testing and operation of all equipment and material. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflict between the requirements of the Contract Documents and the manufacturers' directions, and shall obtain the Architect/Engineer's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturers' directions or such instructions from the Architect/Engineer, he shall bear all costs arising in connection with the deficiencies.

3.02 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of mechanical and electrical equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication Shop Drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement (see other specification sections related to fabrication shop drawings.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part and incompliance with code.

3.03 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation.

Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these Specifications.

D. The contract shall also protect the facility in general. For example, damage to the facility caused by an unprotected roof opening or wall penetration will be the responsibility of this Contractor.

3.04 INSTALLATION METHODS

A. Where to Conceal: All pipes, conduits, etc., shall be concealed in pipe chases, walls, furred spaces, or above the ceilings of the building unless otherwise indicated. Suitable access shall be provided at all access points such as service valves.

B. Where to Expose: In mechanical rooms, janitor's closets tight against pan soffits in exposed "Tee" structures, or storage spaces, but only where necessary, piping may be run exposed. All exposed piping shall be run in the most aesthetic, inconspicuous manner, and parallel or perpendicular to the building lines.

C. Support: All piping, ducts and conduits shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Maintaining Clearance: Where limited space is available above the ceilings below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, rather than hung below them in a manner to provide maximum above-floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Architect/Engineer for each penetration not indicated in the Contract Documents.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping, flues, etc., shall be sloped to obtain the proper pitch. Piping, and ducts run in furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.

1. All piping not directly buried in the ground shall be considered as “interior piping”.

2. Prior to the installation of any ceiling material, gypsum, plaster or acoustical board, the Contractor shall notify the construction supervisor so that arrangement can be made for an inspection of the above-ceiling area about to be “sealed” off. The Contractor shall give as much advance notice as possible no less than ten (10) working days.

3. All above-ceiling areas will be subject to an inspection before ceiling panels are installed, or installation is otherwise concealed from view. All mechanical and electrical work at and above the ceiling, including items supported by the ceiling grid, such as air inlets or outlets and lighting fixtures, shall be complete and installed in accordance with Contract requirements, including power to lighting fixtures, fans, and other powered items. Adequate lighting shall be provided to

permit thorough inspection of all above-ceiling items. Areas to be included and time of inspection shall be coordinated with the Architect/Engineer.

3.05 CUTTING AND PATCHING

A. General: Cut and patch walls, floors, etc., resulting from work in existing construction. Coordinate all cutting and patching with the requirements of the Architect.

B. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact-type equipment shall not be used except where specifically acceptable to the Architect/Engineer. Openings in pre-cast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled to exact size.

C. Restoration: All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes. Coordinate all finish work with the requirements of the Architect.

D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.

E. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Special Note: No cutting, boring, or excavating, which will weaken the structure, shall be undertaken.

3.06 ACCESS DOORS

A. General: This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed items of mechanical equipment or devices.

B. Doors: Access doors mounted in painted surfaces shall be of Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surface of the adjacent finishes. Access doors mounted on tile surfaces shall be of similar construction as noted above, except they shall be of stainless steel materials. Access doors shall be a minimum of 18" x 18" in size, but will otherwise be required to provide full and free access such that valves fully stroke, equipment doors open fully, and all service points on the equipment can be reached and parts can be replaced.

C. Locations: The contractor shall notify architect of locations where doors will be visible in finished areas. Typically doors shall be installed in non-objectionable location.

3.07 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he follows the recommended start-up procedures, and properly supervises the operation, and has the Owner and Architect's written permission to do so. The warranty period, however, shall not commence until the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

3.08 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before the work is accepted, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation, start-up and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. The representative shall also conduct training sessions for each piece of equipment as required by the Owner. The qualifications of the representative shall be appropriate to the technical requirement of the installation. The qualifications of the representative shall be submitted to the Architect/Engineer for approval. The decision of the Architect/Engineer concerning the appropriateness of the representative shall be final. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Architect/Engineer a signed statement from each representative certifying as follows: "I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations".

B. Check inspections shall include plumbing equipment, heating, air conditioning, insulation, ventilating equipment, controls, mechanical equipment and such other items hereinafter specified or specifically designated by the Architect/Engineer.

C. Start-up, Testing and Checking shall be seasonally deferred where required such that it can be operated under load.

3.09 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by that portion of the work.

3.10 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grilles, insulation, etc., furnished and installed in exposed areas under Division 22 and 23 of these Specifications and as hereinafter specified shall be cleaned, prepared, and painted as indicated.

B. All equipment furnished by the mechanical subcontractor shall be delivered to the job with a suitable factory protective finish and shall be painted (if required), after installation, with the color hereinafter specified. The following materials shall not be painted: copper, galvanized metal, stainless steel, fiberglass, and PVC.

C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.

D. Aluminum jacketing on insulation shall not be painted.

E. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible due to the painting operation.

3.11 TESTS

A. The Contractor shall make, at no additional cost to the Owner, any tests deemed necessary by the Architect/Engineer, the inspection departments having jurisdiction, and in the National Fire Protection Association, ASTM, etc. Standards listed. The Contractor shall provide all equipment, materials, and labor for making such tests, Reasonable amounts of fuel and electrical energy costs for system tests will be paid by the Contractor.

B. Additional tests specified hereinafter under the various Specification Sections shall be made.

C. The Architect/Engineer shall be notified in writing at least 10 working days before each test and other Specification requirements requiring action on the part of the Architect/Engineer. All equipment shall be placed in operation and tested for proper automatic control requirements before the balancing agency starts their work. These activities will be seasonally deferred as required to properly operate, load and test the equipment (e.g., evaporative coolers and chillers shall be tested in the summer; boilers and furnace sections shall be tested in the winter.)

D. Maintain Log of Tests as hereinafter specified.

E. See Specifications hereinafter for additional tests and requirements.

3.12 LOG OF TESTS

A. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall

include date, time, personnel, description, and extent of system tested, test conditions, test results, specified results, and other pertinent data. Data shall be delivered to the Architect/Engineer as specified under "Requirements for Final Acceptance". All Test Log entries shall be legibly signed by the Project Contractor or his authorized job superintendent.

3.13 START-UP AND TRAINING

A. "Start-up" and "Training" shall be considered formal and distinct periods in the project, regardless of when they occur in the construction process.

B. Each piece of equipment and system (whether new, existing, by others, etc.) shall be started-up by authorized personnel using manufacturer's recommendations or industry standard practice. Start-up procedures shall be neatly documented in report form and included with operation and maintenance materials for the project.

C. The contractor shall provide a minimum of four (4) sets of filters for each and every piece of equipment that filters are required. This includes all air moving equipment whether exhaust or supply systems and all water system filters. Initial filter shall be for unit protection during installation and construction period. Second filter shall be installed by the contractor immediately prior to the commencement of testing, adjusting and balancing work. Third set shall be installed by the contractor immediately prior to the owner's occupancy of the building. Final set of filters shall be delivered to the owner for their use. The contractor shall carefully document the delivery of the owner's filter set and receive owner's representative signature of delivery. The four sets of filters shall apply to ALL filters whether they are disposable filters or washable/reusable filters.

D. Each piece of equipment and system shall also include training designed to cover the depth of knowledge required to operate and maintain the respective item. Training sessions shall be documented and included with operation and maintenance materials for the project.

3.14 OPERATION AND MAINTENANCE DATA

A. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

B. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

C. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

D. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

E. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

F. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

G. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.

H. Include color coded wiring diagrams as installed.

I. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

J. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

K. Provide servicing and lubrication schedule, and list of lubricants required.

L. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

    a. Constant-volume air systems.

2. Testing, adjusting, and balancing of equipment.
3. Testing, adjusting, and balancing of existing HVAC systems and equipment.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

G. UFAD: Underfloor air distribution.

1.3 SUBMITTALS

A. Qualification Data: submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: submit the Contract Documents review report, as specified in Part 3.

C. Strategies and Procedures Plan: submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: submit system readiness checklists, as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. TAB Specialists Qualifications, Certified by NEBB or TABB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

1.5 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.

L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's

"Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Pumps.
3. Fans and ventilators.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set exhaust-air dampers for proper position.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.

4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

C. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:
1. Fans are clean.
2. Bearings and other parts are properly lubricated.
3. Deficiencies noted in the preconstruction report are corrected.
4. Balance each air outlet.

3.8 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm within 10 cfm.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:

    a. Settings for exhaust-air dampers.

16. Test conditions for pump performance forms, including the following:

    a. Variable-frequency controller settings for variable-flow hydronic systems.
    b. Settings for pressure controller(s).
    c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Position of balancing devices.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and speed.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan speed.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

F. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.

b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

END OF SECTION

SECTION 23 09 00

AUTOMATIC TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Provide a DDC, energy management, and equipment monitoring and control, consisting of the following elements:

1. Microcomputer based Plant Control Processors (PCPs) interfacing directly with sensors and actuators.

2. A two-wire peer communication network to allow data exchange from PCP to PCP at a minimum rate per second of one megabit.

3. Microcomputer based Terminal Equipment Controllers (TECs) interfacing with sensors, actuators, and terminal equipment control devices.

4. Two-wire communication networks interfacing TECs to communication control PCPs.

B. Submittals, data entry, electrical installation, programming, start up, test and validation, instruction of Owner's representative on maintenance and operation, as built documentation, and system warranty.

1.02 SCOPE OF WORK

A. The controls contractor shall provide a complete “Niagara” system to match entire campus and New Mexico State University existing system. This performance based criteria is intended to encompass not only the installation and products, but also the overall use and function of the system. This includes, but is not limited to:

1. Attaining a complete understanding of the project documents. This includes all new equipment or control devices on existing equipment along with the installation of new controls on the existing buildings and equipment that are not directly involved in the construction project.

2. Interfacing with NMSU and the engineer to attain the intent of the system and bidding the project to attain that full intent.

3. Providing and installing labor and materials such that all equipment is controlled in a complete manner, information is gathered and transmitted to the central system, and all system functions are completed in a manner consistent with the requirements of NMSU.

4. Coordination with other trades affected by communications interface, interlock wiring, and any other system related issues.

5. Complete programming of system parameters, reports, schedules, alarms, etc. to the criteria and satisfaction of NMSU's requirements.

6. Complete operational, maintenance, and training services including documentation, demonstrations, classroom work, etc. to the criteria and satisfaction of NMSU's requirements.

1.03 QUALITY ASSURANCE

A. The system shall be installed by competent mechanics, regularly employed by the manufacturers local representative with full responsibility for proper operation of the BCS including debugging and calibration of each component in the system.

PART 2 - PRODUCTS

2.01 BCS HARDWARE

A. Plant Control Processors shall be 16 bit microprocessor based with EPROM operating system (O.S.). DDC programs and data files shall be non-volatile EEPROM or flash memory to allow simple additions and changes. Each PCP shall have an on-board real-time clock with battery backup of a minimum of 30 days.

B. Terminal Equipment Controllers shall be EEPROM based and modularly expandable to accommodate additional points if required for future functional changes or enhancements, and with I/O selected for the application plus specified spares. TECs shall be capable of processing sensor signals of the applications specified, and shall have capability to drive outputs required by the application. TEC enclosures shall be compact, finished steel to fit within or on terminal equipment.

2.02 DATA INPUTS AND OUTPUTS

A. Input/output sensors and devices shall be closely matched to the requirements of the remote panel for accurate, responsive, noise-free signal input/output. Control input response shall be high sensitivity and matched to the loop gain requirements for precise and responsive control. In no case shall computer inputs be derived from pneumatic sensors or thermocouples.

B. Temperature sensors shall be Electronic type of 20K ohm, NTC.

2.03 PCP SOFTWARE

A. Energy Management application programs and associated data files shall be stored in non-volatile memory.

B. Control Software:

1. Each PCP shall contain up to 20 unique user modifiable time programs (TP).

a. Each TP shall consist of daily, weekly, and annual programs plus a "TODAY" temporary function.
b. DAILY programs shall be definable for day types such as working day, half day, holiday, weekend, etc. Each daily program shall allow a list of time based (or optimum time based) analog and digital commands to be issued to user selected plant elements and points.
c. WEEKLY programs shall allow a user selected set of daily programs to be defined for each day of the week (Monday through Sunday).
d. The ANNUAL program shall initially be an automatic compilation of 52 weekly programs. Selecting a date of the ANNUAL program shall allow modification of the daily selection entered into the weekly program (such as changing Dec. 25 from a working day to a holiday).

2. Control Application Software shall be customized strictly to meet the detailed requirements of New Mexico State University Criteria. PCPs shall be fully programmable. Initial software shall be fully modifiable, and not restricted by vendor's specific configuration guidelines. All PCP control software shall be designed via a graphic programming facility, the detailed graphic design of which shall be provided as system documentation. All control strategies shall be advanced as noted with stabilizing setpoint ramps and procedures to assure slow loading of variable load equipment and economizer modes to prevent unsafe overshoot of controlled pressure and unsafe undershoot of mixed air temperatures during start-up and transition periods.

C. Management Software:

1. Each PCP shall monitor all analog input points and specified digital points for off-normal conditions. Alarms shall be displayable on the POT.

2. PCPs managing sub-networks of TECs shall report TEC alarms and shall be programmed to perform data reduction, sorting, and AHU PCP optimizing routines.

D. Communications Software:

1. Each PCP shall have a full master peer-to-peer communications module to support all global data sharing, hierarchical control, and global control strategies specified. In addition, certain PCPs shall have hardware and software to support managing a secondary 9600 baud bus of TECs, including hierarchical control specified, management, alarm processing and prioritization, and TEC to/from PCP peer bus global data sharing and control.

PART 3 - EXECUTION

3.01 GENERAL

A. The Building Control System (BCS) shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner; including all labor. And not noted in other sections of these specifications.

3.02 SEQUENCE OF OPERATION AND DATA POINT REQUIREMENTS

A. Provide fully implemented application and custom software and controls necessary to accomplish the control sequences required:

B. Computer input and output points shall be provided where specified, shown or required to accomplish the requirements of the Sequence of Operation.

C. Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single panel containing the DDC algorithm, and shall function independent of any peer or communication links. Secondary (reset type) analog inputs may be received from the peer network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

3.03 SUBMITTALS

A. Provide 6 copies of submittal data within 60 days of contract award.

B. Submittal shall consist of:

1. Data sheets of all products
    a. Sequence of operation relating to all flowchart functions.

3.04 INSTALLATION

A. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals.

B. The BCS contractor shall be responsible for all electrical installation required for a fully functional control system and not shown on the electrical plans or required by the electrical specifications. All wiring shall be in accordance to all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications. All electronic wiring shall be shielded if required. Fire rated plenum cable is acceptable in concealed spaces.

C. The BCS contractor shall enter all computer programs and data files into the related computers including all control programs, initial approved parameters and settings, and English descriptors.

D. The BCS contractor shall maintain diskette copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training session, and one copy shall be archived in the BCS contractor's local software vault.

3.05 VALIDATION

A. The BCS contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations submitted.

B. Witnessed validation demonstration shall consist of:

1. Display and demonstrate each type of data entry to show site specific customizing capability. Demonstrate parameter changes.

2. Execute digital and analog commands.

3.06 MANUALS

The following manuals will be provided:

A. An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.

B. Computerized printouts of all PCP data file construction including all point processing assignments, terminal relationships, scales and offsets, command and alarm limits, program flowcharts, etc.

C. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.

D. Two Operators Manuals, and two As-Built Manuals shall be provided to the owner.

3.07 TRAINING

A. All training shall be by the BCS contractor and shall utilize specified manuals and as-built documentation.

B. Operator training shall include two four-hour sessions encompassing:

1. Sequence of Operation review

2. Selection of all displays and reports

3. Use of Portable Operators Terminals

C. One training session shall be conducted at system completion, and the other shall be conducted forty five days after system completion.

3.08 WARRANTY

A. All components, system software, parts and assemblies supplied by the BCS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date.

B. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by the BCS contractor at no charge to the owner during the warranty period.

C. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

3.09 SEQUENCE OF OPERATION

A. Sequences of Operation are described on the plans with the control diagrams.

3.10 POINTS LIST

A. Points lists are indicated on the plans with the control diagrams.

END OF SECTION

SECTION 23 31 00

DUCTWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

1.02 RELATED SECTIONS

A. Specification Section for - Supports and Anchors, Sleeves.

B. Specification Section for - Ductwork Accessories.

C. Specification Section for - Testing, Adjusting and Balancing.

1.03 REFERENCES

A. ASTM A 36 - Structural Steel.

B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

C. ASTM A 525 - General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process.

D. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

E. AWS D9.1 - Welding of Sheet Metal.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

G. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

H. SMACNA - HVAC Air Duct Leakage Test Manual.

I. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

J. UL 181 - Factory-Made Air Ducts and Connectors.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Submit under provisions of Specification Section for Submittals.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Specification Section for Record Documents.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

B. Maintain one copy of document on site.

1.08 QUALIFICATIONS

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

B. Installer: Company specializing in performing the work of this section with minimum three years experience.

1.09 REGULATORY REQUIREMENTS

A. Construct ductwork to SMACNA, NFPA 90A standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Schedule 40 CPVC Piping with solvent welded joints.

B. Stainless Steel Ducts: ASTM A167, Type 304.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Sealant:

1. Manufacturers: Benjamin Moore or Equal.
2. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

E. Hanger Rod: ASTM A36; steel threaded both ends, or continuously threaded.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Duct Sizes are inside clear dimensions.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 CLEANLINESS

A. Delivery to site, ductwork delivered from the premises of the manufacturer will have no protection. Care must be taken to prevent damage during transportation and offloading.

B. To maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.

C. Site storage, the area provided for storage shall be clean, dry and exposure to dust minimized.

D. Storage duct shall have all ends sealed and shall be visibly examined and if damaged resealed with an appropriate material.

E. Duct labels for part identification are to be applied to external surfaces only.

F. Before the installation of individual duct sections they are to be inspected to ensure that they are free from all debris.

G. All risers must be covered to prevent the entry of debris into the duct.

H. Installation, the working area should be clean and dry and protected from the elements. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

I. The internal surfaces of the uninsulated ductwork shall be wiped to remove excess duct immediately prior to installation.

J. Open ends on completed ductwork and overnight work-in-progress hall be sealed.

3.03 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
General Exhaust	CPVC

B. DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Return and Exhaust	1 inch

END OF SECTION

SECTION 23 34 23

EXHAUST FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ceiling Mounted Exhaust Fan

B. Roof Mounted Exhaust Fan

1.02 RELATED SECTIONS

A. Specification Section for - Ductwork Insulation.

B. Specification Section for - Ductwork.

C. Specification Section for - Ductwork Accessories, Backdraft dampers.

1.03 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating.

E. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

H. NEMA MG1 - Motors and Generators.

I. UL 705 - Power Ventilators.

J. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.04 SUBMITTALS FOR REVIEW

A. Specification Section for Submittals, Procedures for submittals.

B. Product Data: Provide Construction and Technical data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

1.05 SUBMITTALS AT PROJECT CLOSEOUT

A. Specification Section for Contract Closeout, Operation and Maintenance Data Warranties.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

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

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Specification Section for Material and Equipment, Transport, handle, store, and protect products.

B. Protect motors, shafts, and bearings from weather and construction dust.

C. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Greenheck, Loren Cook, or Equal.

2.02 INLINE CORROSION RESISTANT EXHAUST FANS

A. Inline Corrosive Resistant Fans

Housing
The housing is made of pressure casted black polypropylene. The fans have protection class IP44.

Motors

The Inline Corrosive Fans (ICF) are driven by
a single phase 115 V motor. The ICF is supplied with a power cord attached (115 V).

Mounting
The Inline Corrosive Fans (ICF) are directly mounted into the duct, fixed by clamps. Due to the very low height, the ICF is ideal for use in false ceilings. Six foot three-prong power cord premounted to fan.

Fan Performance Curves
The performance curves have been established using the inlet test method in the test chamber according to DIN 24 163, mounting position B.

Motor Speeds
The ICF has capabilities of running on 3 speeds depending how it is wired (See wiring diagram). Fan comes prewired to high-speed.

Corrosion Resistance
The ICF is corrosion resistant. The motor is totally
encapsulated in a polypropylene cover.

2.03 ROOF EXHAUST FANS

A. Model: Greenheck model GB or equal.

B. Type: Centrifugal belt driven. Rated at 4,000 ft. elevation and air stream at 70□F.

C. Wheel and Inlet: The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength and a birdscreen around the perimeter of the inlet.

D. Motor Construction: Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance and shall be UL Listed.

E. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

F. Drives: Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron

type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.

G. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

H. Bearings: Pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.

I. Labeling on Unit: All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

J. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

K. Provide each unit with insulated roof curb and backdraft damper unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Specification Section for Quality Control, Manufacturer's instructions.

B. Install fans with resilient mountings and flexible electrical leads.

C. Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Provide adjustable sheaves required for final air balance.

E. Provide safety screen where inlet or outlet is exposed.

F. Provide backdraft dampers on inlet or discharge of exhaust fans and as indicated. Do not install grease exhaust systems with backdraft dampers.

G. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

H. Install on level on roof curbs as indicated. Isolate and anchor per manufacturer’s instructions.

I. Coordinate with electrical for routing of conduit. Do not cut fan housing to route conduit.

END OF SECTION

SECTION 26 0000

BASIC ELECTRICAL MATERIALS AND METHODS

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. General: This section specifies several categories of provisions for electrical work including: 1) Certain adaptive expansions of requirements specified in Division 1, 2) General performance requirements within the electrical systems as a whole, and 3) General work to be performed as electrical work, because of its close association.

1.3 SUMMARY OF NEW ELECTRICAL 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. General Outline: The facilities and systems of the electrical work can be described (but not by way of limitation) as follows: 1) Electrical power and distribution system, including the electrical connecting of equipment not specified to be connected as work of another division, 2) Motor starters and control/protection work as indicated, and 3) Systems of branch circuits for lighting and convenience outlets.

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 mechanical work, and that such establishment is the exclusive responsibility of the Electrical Subcontractor.

1. 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.

2. Locate operating and control equipment properly to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance.

3. Advise other trades of openings required in their work for the subsequent move-in of large units of electrical work (equipment).

B. Coordination Drawings: For locations where several elements of electrical (or combined mechanical and electrical) work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation if deemed necessary by Architect/Engineer. Prepare and submit these coordination drawings, if required, prior to purchase-fabrication-installation of any of these elements involved in the coordination.

C. The drawings and these specifications are complementary, each one to the other, and what is called for by one shall be as binding as if called for by both. Carefully examine the drawings and specifications and report any discrepancies affecting the work to the Architect/Engineer. The Architect/Engineer will issue such written instructions or interpretations as may be required.

D. 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.

E. Circuits and feeders shall be as shown and no deviations from the indicated outlet-circuit grouping will be permitted, except by permission of the Engineer. Branch circuit numbers are for guidance only and need not necessarily conform to the finished job. Actual circuit numbers used shall be recorded on the "as-built" drawings.

F. 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.

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. AWS standards for welding.

2. ANSI C 2, National Electrical Safety Code.

3. ANSI C 73, Dimensions of attachment plugs and receptacles.

4. NECA standards for installation.

5. 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, 2011 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 SUBMITTALS

A. General: Refer to Division 1 for general requirements concerning work related and administrative submittals. All descriptive and technical data and shop drawings shall bear signed certification by the General Contractor and Electrical Subcontractor (both) to the effect that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Submittals will be rejected if signed certification is not included. Where catalog data are submitted, the proposed items shall be clearly "flagged" or otherwise identified, so that no confusion exists.

1.9 TEMPORARY FACILITIES

A. General: Refer to the Division 1 sections for general requirements on temporary facilities. Except for self-contained facilities, connect and terminate electrical temporary facilities at the locations indicated or, if not otherwise indicated, at locations as determined by the Electrical Subcontractor to fulfill project requirements.

B. Do not interrupt or disrupt power service to existing facilities of the Owner or others, except with prearrangement and agreement on time of interruption as needed to make temporary connection for temporary power service.

C. Do not subject electrical facilities (either temporary work or temporary use of permanent work) to higher demand or loading than designed for.

D. When temporary electrical service is no longer needed for construction work, remove electrical temporary facilities and temporary provisions of all permanent electrical work. Repair and restore (or replace) work damaged by installation and operation of electrical systems which have been used to normal wear.

E. Electrical work installed as temporary facilities shall, upon removal, remain the property of the installer.

F. Replace worn parts of permanent electrical work, where used as temporary facilities prior to the Owner's acceptance and assumed operation. Where lamps of permanent electrical light fixtures have been used for temporary lighting, replace lamps which have burned out or are noticeably dimmed by temporary use.

1.10 PRODUCTS, ELECTRICAL WORK

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:

1. All material 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.

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

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

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

5. 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.

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

B. 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.

C. Substitution: Manufacturer's catalog numbers are specified for the purpose of establishing a standard. All proposed substitutions on specific materials (lighting fixtures, panelboards, fire alarm system components, but not limited to) shall be equal substitutes. The entire burden of proof of equality shall be placed on the Electrical Subcontractor and the decision of the Architect/Engineer shall be final. Prior approvals will not be officially processed. All other electrical equipment, devices, etc. may have substitutions only if equal in quality and function to, or better than, the specified item. 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.

D. 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 Architect/Engineer before starting work. Commencement of work signifies the 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.

PARTS 2 AND 3 PRODUCTS AND EXECUTION

3.1 ELECTRICAL SYSTEM IDENTIFICATION

A. General: Provide engraved plastic laminated nameplates at all locations of major units of electrical equipment including panelboards, control centers, alarm and similar systems. Nameplates shall be constructed from laminated phenolic plastic, 1/8 inch thick, 3-ply with black surfaces and white core. Engraving shall be with Roman Gothic lettering, 3/16 inch high, appropriately spaced. Nameplates shall be attached to control devices by use of self tapping flat head chromium plated screws unless approved otherwise. Screw tips on inside of device cover shall be filed to provide a smooth, non-abrasive finish. Gluing, taping and riveting of nameplate to control device is not acceptable. Nameplate information shall include name of panel/equipment, panel electrical characteristics and branch/feeder circuit designation, which feeds it. Nomenclature on nameplate(s) shall be similar to the following examples:

Panelboards:	Panel AP1 120/208V, 3PH, 4W	CCT. A-28
Roof Top Units	Air Handler AHU-2	CCT. M2-2
Exhaust Fan	EF-5	CCT. P-4

B. All junction boxes (including switch and device boxes) shall have circuit number that device is connected to or switch controls inscribed on cover of box. In finished areas the circuit number shall be engraved on device plate (or attached laminated nameplate), all other boxes shall have circuit number(s) indicated with permanent marker.

3.2 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as individually authorized by the Architect/Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

B. Structural Limitations: Do not cut structural framing, walls, floors decks and other members intended to withstand stress, except with the Architect/Engineer's written authorization. Authorization will be granted only where there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.

C. Patching: Where patching is required to restore other work because of either cutting or other damage inflicted during the installation of electrical work, engage the original installer (respective trade) to complete the patching of the other work. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect/Engineer.

3.3 CONCRETE FOR ELECTRICAL WORK

A. General: The work of this article is defined to include whatever concrete work is necessary or shown specifically to install the electrical work; but excluding equipment base grouting (see applicable Division 26 sections). Coordinate the work with other work, particularly other concrete work and accessories.

1. General Standards: Except as otherwise indicated, comply with applicable provisions of Division 3 sections for electrical work concrete, including form work, reinforcement, mix design, materials (if not noted on drawings, use mix designs and materials accepted for Division 3 work where possible), admixtures, accessories (including waterstops), placing of wet concrete, finishing, curing, protecting, testing, submittals, and other requirements of the concrete work. Refer instances of uncertain applicability to the Architect/Engineer for resolution before proceeding.

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 Architect/Engineer.

C. Furnish all instruments and labor for testing.

D. Coordination with Mechanical: Coordinate closeout operations with closeout of mechanical systems and other power consuming equipment. Accurately record on "as-built" drawings locations

of all feeder conduits, which are underground or otherwise concealed. Test run electrical equipment in coordination with test runs of mechanical system. Clean and lubricate operational equipment. Instruct Owner's operating personnel thoroughly in the operation, sequencing, maintenance and safety/emergency provisions of the electrical systems. Turn over the operations to the Owner's personnel at the time(s) of substantial completion. Until the time of final acceptance of the total work of the contract, respond promptly with consultation and services to assist the Owner's personnel with operation of the electrical systems.

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 MISCELLANEIOUS 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.

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 Owner.

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 Architect/Engineer.

END OF SECTION

SECTION 26 0200

RACEWAYS

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.

B. This section is a Division 26 Basic Materials and Methods section, and is part of each Division 26 section making reference to electrical raceways specified herein.

1.2 SUMMARY

A. This Section includes raceways for (electrical wiring) 600V and below electrical circuits and control wiring. Types of raceways in this section include the following:

1. Electrical metallic tubing (EMT).

2. Flexible metal conduit.

3. Liquidtight flexible conduit.

4. IMC.

1.3 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

B. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to raceways.

C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate with other Work, including re-roofing and ductwork deck installation, as necessary to interface installation of electrical raceways and components with other Work.

1.5 SUBMITTALS

A. None Required.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical raceway system indicated, provide assembly of conduit or tubing, and fittings including, but not necessarily limited to, connectors, couplings, offsets, elbows, straps, bushings, expansion joints, hangers and other components and accessories as needed for a complete system. Minimum size conduit shall be 3/4" U.N.O.

B. EMT connectors and couplings shall be of the steel set screw or watertight threaded compression type, having steel gland nuts. Connectors shall have insulated throats.

2.2 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.

B. Sealing Fittings: Threaded, zinc or cadmium plated, cast or malleable iron type for steel conduits.

C. Rigid Aluminum Conduit: Not acceptable on this project.

D. Electrical Metallic Tubing and Fittings: ANSI C80.3. Steel tubing, may be used in sizes up to and including 3 inch, concealed locations only.

E. Flexible Metal Conduit: UL 1, aluminum, not acceptable.

F. Flexible Metal Conduit: UL 1, zinc-coated steel, 3/4" minimum size U.N.O. (3/8" flexible conduit is not acceptable), with a separate grounding bond wire installed in the conduit in addition to other wires.

G. Flexible Metal Conduit Fittings: Either steel or malleable iron only, with insulated throats and shall be one of the following types:

1. Wedge and screw type with angular wedge fitting between the convolutions of the conduit.

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

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

H. Liquid-Tight Flexible Metal Conduit and Fittings: UL 360. Provide liquid-tight flexible metal conduit; constructed of single strip, flexible, continuous, interlocked, and double-wrapped steel, galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC) and a continuous copper bonding conductor wound spirally between the convolutions. To be UL labeled Sealtite type UA or Liquidtite type LA.

I. Liquid tight flexible conduit fittings shall be provided with threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat.

2.3 CONDUIT BODIES

A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

B. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.

C. Conduit Bodies 1 Inch and Smaller: Use bodies with compression-type EMT connectors.

2.4 IMC

A. Conduits installed on the roof for other than stub ups through the roof top to an AC unit shall be IMC. Provide with threaded couplings. Store conduit properly and properly thread and de-burr all conduits that are cut to size.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Outdoors: Use the following wiring methods:

1. Exposed on Roof: IMC for conduit runs other than stub ups through roof.

2. Connection to Vibrating Equipment: liquidtight flexible metal conduit.

B. Indoors: Use the following wiring methods:

1. Connection to Vibrating Equipment: flexible metal conduit.

2. Exposed: electrical metallic tubing.

3. Concealed: electrical metallic tubing.

3.2 INSTALLATION

A. General: Install electrical raceways for all wiring circuits in accordance with manufacturer's written instructions, applicable requirements of NEC 2011,, and as follows:

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations. Run all conduits in a manner satisfactory to the Owner's duly authorized representative. On exposed systems, support shall be provided at intervals of 6 feet.

C. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.

D. Complete installation of electrical raceways before starting installation of conductors within raceways. All ends of the conduit shall be properly reamed to remove rough edges and whenever a conduit enters a box or other fitting, it shall be securely fastened by the use of a locknut inside and outside of the box or fitting. An approved bushing shall be installed on the ends of all conduit in such a manner as to protect the wire from abrasion. Upon completion of installation or raceways, inspect interiors of raceways; remove burrs, moisture, dirt and construction debris.

E. Support raceways rigidly by means of straps or hangers best suited for the work. Conduit shall not be supported from ceiling. Multiple runs of conduits shall be racked on trapeze hangers. All support materials shall be rustproof. Perforated tape or wire shall not be used. DO NOT USE WIRE TO SUPPORT OR ANCHOR ANY CONDUIT.

F. Prevent foreign matter from entering raceways by using temporary closure protection. Seal raceways after installation to prevent accumulation of water, dirt and other foreign materials. Conduit in which such accumulation occurs shall be cleaned to the satisfaction of the Architect/Engineer or replaced.

G. Conduit crossing expansion joints shall be provided with suitable expansion fitting. Per NEC 2011, Article 300.

H. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location.

J. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.

K. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases provided field bends for parallel raceways.

L. Join raceways with fittings designed and approved for purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding busings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

M. Tighten set screws of threadless fittings with suitable tool.

N. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

O. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

P. Install pull wires in empty raceways. Use no. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire. Identify each terminus of pull wire with linen tags marked with complete information as to service and location of the terminus of the line/wire.

Q. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.

2. Where required by the NEC.

R. Fire Barriers: Contractor shall be responsible for sealing all conduit penetrations through fire rated walls and ceilings. The seal shall be acceptable to Architect/Engineer and maintain the integrity of the wall, ceiling fire rating. 3M brand fire barrier caulk #CP 25 and putty #303 are considered acceptable for this purpose. Refer to architectural drawings for these locations.

3.3 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

END OF SECTION

SECTION 26 0503

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This section is a Division 26 Basic Materials and Methods section, and is part of each Division-25 and -26 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Applications of electrical connections specified in this section include the following:

1. From electrical source to motor starters.

2. From motor starters to motors.

3. To grounds including earthing connections.

C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division-25 and other Division-26 sections, and are work of this section.

D. Motor starters and controllers, not furnished as integral part of equipment, are specified in applicable Division-26 sections, and are work of this section.

E. Refer to Division-25 sections for motor starters and controllers furnished integrally with equipment; not work of this section.

F. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division-26 sections, and are work of this section.

G. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division-26 sections, and are work of this section.

H. Refer to other Division-26 sections for junction boxes and disconnect switches required for connecting motors and other electrical units of equipment; not work of this section.

I. Refer to Division-25 for control system wiring; not work of this section.

J. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturer: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEC Compliance: Comply with applicable portions of 2011 NEC, as to type of products used and

installation of electrical power connections (terminals and splices), junction boxes, motor starters, and disconnect switches.

C. IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.

D. ANSI Compliance: Comply with applicable ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.

E. UL Compliance: Comply with UI Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL-listed and -labeled.

F. ETL Compliance: Provide electrical connection products and materials which are ETL-listed and -labeled.

1.4 SUBMITTALS

A. None Required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver electrical connection products wrapped in proper factory-fabricated type containers.

B. Store electrical connection products in original cartons and protect from weather, construction traffic and debris.

C. Handle electrical connection products carefully to prevent breakage, denting, and scoring finish.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices and terminations of the type indicated.

B. Metal Conduit, Tubing and Fittings:

1. General: Provide metal conduit, tubing and fittings of the types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division-26 basic materials and methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings.

a. IMC.
b. IMC Fittings.
c. Electrical metallic tubing.
d. EMT fittings.
e. Flexible metal conduit.
f. Flexible metal conduit fittings.
g. Liquid-tight flexible metal conduit.
h. Liquid-tight flexible metal conduit fittings.

C. Wire, Cable, and Connectors:

1. General: Provide wires, cables and connectors complying with Division 26 basic electrical materials and methods section "Wires and Cables".

2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections, which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F).

3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify General Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Contractor has full responsibility to verify whether circuit is energized or not and to perform all necessary lock-out/tag-out.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulation equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering, armor, jacket and insulation properly to ensure a uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.

I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where

subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:

1. Exterior location.

2. Moist or humid atmosphere where condensate can be expected to accumulate.

3. Corrosive atmosphere.

4. Water spray.

5. Dripping oil, grease, or water.

J. Coordinate installation of electrical connections for equipment with equipment installation.

K. Perform all work in conformance with job requirements, other applicable sections of these specifications, governing codes and ordinances, and manufacturer's instructions.

3.3 EQUIPMENT REQUIREMENTS

A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Electrical Subcontractor shall make any required changes to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, at no additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

B. Motor starters and motor control devices that are not an integral part of the mechanical equipment but are furnished with equipment will be turned over to the Electrical Subcontractor for installation and connection.

C. Obtain from Mechanical Subcontractor a complete list of all mechanical equipment including load, voltage, phase, etc., at beginning of job prior to installation of any related electrical services. Advise Architect/Engineer of changes and adjust to meet requirements.

D. Electrical equipment shall be identified by the attachment of engraved nameplates as specified.

E. Complete all identification cards for switches, starters and other devices in all distribution panelboards and similar pieces of equipment, on a typewriter in a neat manner and insert the card in the card holder behind a piece of clear plastic. Where the card size is insufficient for the proper identification of all circuits, the index shall be made on a large sheet of paper of proper proportion, and then photo-reduced to fit the card holder.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

SECTION 26 0519

WIRES AND CABLES

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.

B. This section is a Division 26 Basic Materials and Methods section, and is part of each Division 26 section making reference to wires and cables specified herein.

1.2 SUMMARY

A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

B. The applications for cable, wire and connectors required on the project are as follows:

1. Power distribution circuitry

2. Lighting circuitry

3. Equipment connections and controls circuitry

4. Special systems

1.3 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01340, "Submittals."

B. Product Data: Submit manufacturer's data on electrical wire, cables, conductors, connectors and connector crimping tools where specified.

1.4 QUALITY ASSURANCE

A. American Society for Testing and Materials (ASTM): Comply with requirements of the following:

1. Standard Specification for Hard-Drawn Copper Wire

2. Standard Specification for Medium-hard-Drawn Copper Wire

3. Standard Specification for Soft or Annealed Copper Wire

B. Electrical Testing Laboratories, (ETL): Provide wiring, cabling and connector products, which are ETL listed and labeled.

C. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems.

D. Test Procedure for Impulse Voltage Tests on Insulated Conductors

E. Recommended Practice for Electric Power Systems in Commercial Buildings

F. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

G. National Electrical Manufacturers Association (NEMA): Comply with requirements of the following:

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

I. UL: Provide material conforming to the following standards.

J. Thermoplastic-Insulated Wires and Cables

K. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors

L. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Wire and Cable:
   a. American Insulated Wire Corp.
   b. Brintec Corp.
   c. Carol Cable Co. Inc.
   d. Senator Wire and Cable Co.
   e. Southwire Company.

2. Connectors for Wires and Cable Conductors:
   a. AMP
   b. 3M Company
   c. O-Z/Gedney Co.
   d. Square D Company.

2.2 WIRES AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Conductors: Provide solid conductors for power and lighting circuits No. 10 AWG and smaller. Provide stranded conductors for sizes No. 8 AWG and larger.

C. Conductor Material: Copper, 98% conductivity, for all wires and cables.

D. Insulation: Provide THHN/THWN insulation for all conductors size 500KCMIL and larger, and No. 8 AWG and smaller. For all other sizes provide THW, THHN/THWN insulation as appropriate for the locations where installed.

E. Color Coding for Phase Identification: Color code feeder, and branch circuit conductors with factory applied color as follows:

208Y/120 Volts	Phase	480Y/ 277 Volts

Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Grey
Green	Ground	Green

F. The colors shall be factory-applied entire length of the conductors by one of the following methods except as noted and limited below:

1. Solid color compound.

2. Solid color coating.

3. Surface printing every 12 inches, maximum spacing of 18 inches.

4. All branch circuit conductors Nos. 12 AWG and 10 AWG shall be solid color compound or solid color coating.

5. All sizes of conductors used for neutrals and equipment grounds shall be solid compound or solid color coating white and green, respectively.

6. All phase conductors No. 8 AWG and larger color coded with pressure sensitive tape shall have a background color other than white or green.

7. Field applied color coding methods may be used in lieu of factory coded wire in sizes larger than No. 10 AWG.

8. Color pressure-sensitive plastic tape shall be applied in half overlapping turns for a distance of six inches or all terminal points and in all boxes in which splices or taps are made. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Color coding shall be with Scotch 35 tape by 3M Company or equal.

9. Tape shall be 3/4-inch wide and colors shall be as specified.

10. Cable identification markings shall not be obliterated by taping and tape locations may be adjusted slightly to prevent obliteration of cable marking.

G. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs or grade, and where indicated.

H. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application.

I. All wire on this project shall be new, unused, in good condition and shall be delivered in standard coils, packages and reels. Samples of all wire shall be submitted by the Electrical Subcontractor when so requested by the Owner's duly authorized representative for the purpose of determining acceptability of the wire. Wire which has been rejected by the Architect/Engineer, shall not be used again. Such rejected wire shall be removed from the Owner's premises forthwith. Decisions as to the quality of the wire furnished and the acceptance of such wire shall be made by the Architect/Engineer.

J. Size of conductors shall be not less than indicated. Branch circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long shall be No.

10 AWG. The sizing of all wire except remote control wire shall be accomplished in the case of branch circuits by conforming to the following provisions: The voltage drop in the branch circuits shall not exceed 2.0% at maximum load and 70.0% power factor. Feeders shall not exceed 1% voltage drop at maximum load and 85% power factor, iron conduit only considered.

K. Remote control wires other than class 2 remote control and signal circuits, shall be no smaller than #14 conductors. Control wires shall be run in separate conduits.

L. Lighting fixtures shall not be used for raceways for circuits other than parallel wiring of fixtures. Install 90 degree C. minimum insulation wire within fixture wireways of fluorescent lighting fixtures.

M. When leaving a metal raceway or conduit in a cabinet, box, switch enclosure, control enclosure or any other like member, conductors shall be protected by means of insulated bushings or end fittings. Conductors may be run in multiple sizes 1/0 to 500 KCMIL inclusive provided all multiple conductors are the same size, length and type of insulation. Not more than three conductors may be run in multiple, and they shall be so arranged and terminated as to insure equal division of the total current between all conductors involved. Where multiple connection is contemplated, approval of the Architect/Engineer must be obtained before installation is made.

2.3 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

B. No splices or taps shall be made at any conductors except in outlet boxes, pullboxes, junction boxes, panelboard boxes, splice boxes or other exposed locations. All taps and splices shall be made with solderless connections and insulated in a manner providing an effective insulation equal to that of the adjoining wire insulation. Any splice or tap shall be made only on such conductors as are a component part of a single circuit.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated.

B. Wire: install all wire in raceway.

C. General: Install electrical cables, wires and connectors in compliance with NEC.

D. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Prior to pulling cables or conductors into raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

E. Pull conductors simultaneously together where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, when necessary. Care shall be exercised while installing wire in conduits so as not to injure conductors insulation. Bending radius of insulated wire or cable shall not exceed manufacturer's recommended values.

F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to line or cable. Maximum pulling tension on any wire or cable shall not exceed manufacturer's recommended values.

G. Conceal all cable in finished spaces.

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

I. Keep conductor splices to a minimum. Splices shall not be permitted except in junction boxes, outlet boxes or as previously listed in this section. Splices must be accessible.

J. Install splices and taps connectors which possess equivalent or better mechanical strength and insulation rating conductors being spliced.

K. Use splice and tap conductors which are compatible with the conductor material.

L. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

M. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.2 FIELD QUALITY CONTROL

A. Prior to energization, test wires for electrical continuity and for short circuits.

B. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 0526

GROUNDING

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.

B. Division 26 Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of grounding is indicated by drawings.

B. Types of grounding in this section include the following:

1. Separately derived systems

2. Enclosures

3. Systems

4. Equipment

1.3 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to electrical grounding.

B. ANSI/UL Compliance: Comply with requirements of ANSI/UL and UL standards pertaining to grounding. Provide products which have been UL listed and labeled.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data on grounding devices and accessories as required.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. General: Except as otherwise indicated, provide for each electrical grounding indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where more than one type meets indicated requirements, selection is installer's option. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

B. General: Provide conduit, tube, duct and fittings complying with Division 26 Basic Materials and Methods section, "Raceways", in accordance with the following listing:

1. Rigid steel conduit

2. Electrical metallic tubing

3. Liquid-tight flexible metal conduit

4. Rigid metal conduit fittings

5. EMT fittings, Type I

6. Flexible metal conduit fittings

7. Liquid-tight flexible metal conduit fittings

2.2 ELECTRICAL BONDING JUMPERS

A. Bonding Jumper Braid: Copper braided tape, constructed of 30 gauge bare copper wires and properly sized for indicated applications.

B. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30 gauge bare copper wire; 3/4" wide, 9-1/2" long; 48.250 CM. Protect braid with copper bolt hole ends with holes sized for 3/8 dia. bolts.

2.3 ELECTRICAL GROUNDING CONDUCTORS

A. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. All non-metallic conduits and ducts shall have grounding conductors as noted on the drawings or required by NEC.

2.4 CONNECTORS, TERMINALS AND CLAMPS

A. Provide connectors, terminals and clamps as recommended by connector, terminal and clamp manufacturer for indicated applications.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL GROUNDING

A. General: Install electrical grounding systems as indicated on the drawings, in accordance with recognized industry practices to ensure grounding protection complies with requirements. Comply with requirements of NEC, NESC, and NEMA standards for installation of grounding systems and devices. All non-metallic conduits and ducts shall have grounding conductors as noted on the drawings or required by NEC.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system and ground-fault protection devices with other work.

C. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.2 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground non-current carrying metal parts of the wiring system or apparatus connected to the system.

B. Common Ground Point: Establish one common ground point for interconnection of the equipment

grounding system and the service grounding electrode Conductor.

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

D. Conduits: Where metallic conduits terminate without mechanical connection, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Install grounding conductor in each nonmetallic conduit or duct and in all flexible conduit that does not have a built-in ground conductor. Those raceways used for telephone, sound, or low-voltage signals do not require a grounding conductor. All conduits terminating at communication backboards shall be provided with grounding bushings.

E. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment ground conductor for single phase branch circuits where indicated on the drawings. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor.

F. Devices: Where a branch circuit ground conductor is not available, install a minimum No. 12 green insulated equipment bonding conductor. Bond conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles. This will be required regardless of receptacle being approved for application without separate bond conductor.

G. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center or separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor.

H. Separately Derived Systems: Transformers creating separately derived distribution systems shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground. A separate grounding conductor shall be extended to a made electrode as noted on the drawings.

3.3 GROUNDING CONDUCTORS

A. The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250.94(a) including the conductor for the made electrode. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Equipment grounding conductors shall be green insulated conductors with insulation equivalent to the insulation on the associated phase conductor, but not less than Type THW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards or transformers, the equipment grounding conductor shall be continuous without splices. All connections shall be available for inspection and maintenance.

B. Connections: Clean surfaces thoroughly to bare metal before applying ground lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with "Galvanox", or equal. All grounding system connections which are made in inaccessible locations, i.e. underground, within concrete slabs, shall be made with Cadweld connections or approved equal.

END OF SECTION

SECTION 26 0533

ELECTRICAL BOXES AND FITTINGS

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.

B. This section is a Division 26 Basic Materials and Methods section, and is part of each Division 16 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of electrical box and associated fitting work is indicated by drawings and in schedules.

B. Types of electrical boxes and fittings specified in this section include the following:

1. Outlet boxes
2. Junction boxes
3. Pull boxes
4. Bushings
5. Locknuts
6. Knockout closures

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been satisfactory use in similar service for not less than 3 years.

B. NFPA Compliance: Comply with NEC 2008, as applicable to construction and installation of electrical boxes and fittings.

C. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.

D. NEMA Compliance: Comply with applicable requirements of NEMA Stds/ Pub No.'s OS1, OS2 and Pub 250 pertaining to outlet and device boxes, covers and box supports.

E. Federal Specification Compliance: Comply with applicable requirements of FS W-C-586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies and Entrance Caps".

1.4 SUBMITTALS

A. None required except as may be specifically requested by the owner or A/E.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with thread screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements of individual wiring situations. Choice of accessories is installer's code-compliance option.

C. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.

D. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.

E. Boxes for use with raceway systems shall not be less than 2-1/8 inches deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture and power (and telephone outlets) shall be not less than 4 inches square.

F. Raintight Outlet Boxes: Provide corrosion-resistant cast metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit. Outlet boxes shall be mounted in the horizontal position so that weatherproof covers fully protect the receptacle when the cover is open.

G. Junction and Pull Boxes: Provide galvanized code gauge sheet steel junction and pull boxes with screw on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. Junction and pull boxes called for to be flush in finished areas shall be of telephone cabinet construction. Cabinet shall have a continuous hinge at door with flush lock on cover and over sized trim to cover wall rough-in.

H. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, constructed with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

I. Bushings, Knockout Closures and Locknuts: Provide corrosion resistant punched steel box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway work.

C. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap all unused knockout holes where blanks have been removed.

E. Install electrical boxes and conduit bodies in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Position recessed outlet boxes accurately to allow for surface finish thickness.

G. Boxes shall be square and flush with finished surfaces and suitably anchored in place. The front edges of the boxes or plaster rings shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of combustible construction, not more than 1/4 inch back of same. Mount boxes with the long axis of devices vertical, unless specifically noted otherwise.

H. Boxes in plastered walls and ceilings shall be provided with plaster rings. A multiple of box extensions and/or covers will not be permitted. Rough-in installations which require box extensions shall be abandoned and the rough-in work redone. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work.

I. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

J. Fasten boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Wire shall not be used to anchor boxes to structure.

K. Provide electrical connections for installed boxes. Where several feeders pass through a common pullbox, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

L. Splices in switch boxes shall be kept to a minimum.

M. On all ceiling outlets involving fixture hanging from boxes, 3/8" no-bolt fixture studs shall be used for light load and 1/2" no-bolt fixture studs shall be used for heavy loads.

N. Where an atmosphere laden with moisture exists, Type FD Series Unilet Boxes shall be used with standard devices. The covers employed shall be adapted for the particular application involved. In such cases, brass screws shall be used and due provision shall be made in all cases, for the escape of any condensate which might accumulate.

O. Mounting Heights: The mounting height of a wall mounted outlet box shall mean the height from the finished floor to the horizontal center line of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. Verify with the Architect. Once mounting height is adjusted because of mortar bed joint, all similar wiring devices within the room or within view shall be adjusted accordingly.

P. Wall Mounted Switch, Receptacle and Signal Outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to trim. Install outlet boxes near the doors on the lock sides as shown on architectural drawings, unless locations are approved by the Architect.

1. Subsequent to installation of boxes, protect boxes from construction debris and damage.

Q. Pull Boxes: Provide additional pull boxes wherever necessary to meet requirements for maximum length of conduit runs and maximum number of bends. Conduit runs with not more than two ninety degree bends shall not exceed 200 feet.

R. Grounding: Upon completion of installation work, properly ground electrical boxes and demonstrate

compliance with requirements.

S. Identification: All junction and pull boxes above the ceiling shall be labeled as to the circuits contained. Blank steel covers on 4 square boxes may be labeled with permanent black marker, hand written with panel name and circuit numbers. Larger boxes may have handwritten labeling if neatly performed.

T. Grounding: Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION

SECTION 26 2200

TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. Extent of transformer work is indicated by drawings and schedules.

B. Types of transformers specified in this section include the following:

1. Dry-type transformers. (TP-1)

C. Electrical wiring connections for transformers are specified in applicable Division-26 sections.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of power/ distribution transformers of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects utilizing electrical power and distribution transformers similar to those required for this project.

C. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

D. NEMA Compliance: Comply with applicable portions of NEMA Std Pub/ No.'s TR 1 and TR 27 pertaining to power/distribution transformers.

E. ANSI Compliance: Comply with applicable requirements of ANSI Standards C57-Series pertaining to power/distribution transformers.

F. NEMA Compliance: Comply with requirements of NEMA Std Pub/No.'s ST 20; "Dry-Type Transformers for General Applications", TR 1, and TR 27.

G. UL Compliance: Comply with applicable requirements of ANSI/UL 506; "Safety Standard for Specialty Transformers". Provide power/ distribution transformers and components which are UL-listed and labeled.

H. NESC Compliance: Comply with applicable requirements of National Electrical Safety Code (ANSI Std C2) pertaining to indoor and outdoor installation of transformers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data including rated kVA, frequency, primary and secondary voltages, percent taps, polarity, impedance and certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, % impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient temperature, sound level in decibels, and standard published data. This data is required as part of shop drawings prior to approval of submittal. Failure to include this information shall be reason for rejection of submittal.

B. Shop Drawings: Submit manufacturer's drawings indicating dimensions, and weight loadings for transformer installations, showing layouts, mountings and supports, spatial relationship to panelboards and associated equipment, include transformer connections to electrical equipment.

C. Wiring Diagrams: Submit wiring protection and control diagrams for power distribution transformers. Clearly differentiate between portions of wiring that are manufacturer-installed and portions to be field-installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

1. General Electric Co.
2. Square D Co.
3. Siemens
4. Substitution as permitted and reviewed by engineer.

2.2 POWER/DISTRIBUTION TRANSFORMERS

A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. Energy Efficient General Purpose TP-1 transformers: Provide factory-assembled, general-purpose, ventilated, (115 degree C) dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated; 3-phase, 60-hertz, with 480 volt delta-connected, and 208/120 volt, 4 wires wye-connected, with grounded neutral. Provide primary windings with 6 taps. Insulate with Class 220 insulation. Rate transformer for continuous operation at rated kVA. Limit terminal compartment temperature to 75 degrees C when transformer is operating continuously at rated load with ambient temperature of 40 degrees C. Provide wiring connections suitable for copper wiring. Integrally mount vibration isolation supports between core and coil assembly and transformer enclosure; electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Do not exceed maximum sound-level rating of 50 db as determined in accordance with ANSI/NEMA standards. Provide transformers with fully-enclosed weather-resistant steel enclosures, and lifting lugs. Apply manufacturer's standard light gray outdoor enamel over cleaned and phosphatized steel enclosure. Transformer windings shall be copper.

C. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

D. VIBRATION MOUNTS: Furnish four vibration isolation cup mounts for each transformer. Mounts shall be as manufactured by the Barry Company and shall be of adequate rating for the load imposed and as recommended by the manufacturer. No other type vibration mounts will be approved.

E. RACEWAY TERMINATION AT TRANSFORMER: "Sealtite" flexible metallic conduit.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which power/ distribution transformers and ancillary equipment are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Install units on vibration mounts as shown; comply with manufacturer's indicated installation method, if any.

D. Connect transformer units to electrical wiring system; comply with requirements of other Division-26 sections.

E. After occupancy of the building has taken place and nominal building power loads established, take voltage readings at all panelboards. Based on these readings, make final adjustments of primary taps on all transformers in the building as directed.

F. Transformers creating separately derived distribution systems shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground. A separate grounding conductor shall be extended to a made electrode consisting of not less than twenty feet of #4 minimum bare copper conductor encased along the bottom of the nearest exterior concrete foundation footing in direct contact with the earth. Bond this footing ground to the other elements of the grounding electrode system.

G. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

3.3 GROUNDING

A. Provide equipment grounding connections for power/distribution transformers as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.4 TESTING

A. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications.

B. Prior to energization, check circuitry for electrical continuity, and for short-circuits.

C. Upon completion of installation of transformers, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units or components, and proceed with retesting.

D. Provide High Voltage labeling as required.

END OF SECTION

SECTION 26 2419

MOTOR AND CIRCUIT DISCONNECTS

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.

B. This section is a Division 26 Basic Materials and Methods section, and is part of each Division 26 section-making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK

A. The extent of motor and circuit disconnect switch work is indicated by drawings and schedules.

B. The types of motor and circuit disconnect switches in this section include the following:

1. Equipment disconnects
2. Appliance disconnects
3. Motor-circuit disconnects

1.3 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical motor and circuit disconnect switches.

B. UL Compliance and Labeling: Provide motor and circuit disconnect switches which have been UL listed and labeled.

C. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Publ. No. KS1.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations for each type of motor and circuit disconnect switch required.

PART 2 - PRODUCTS

2.2 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of switch):
1. Cutler-Hammer, Inc.
2. General Electric Co.
3. Square D Company
4. Westinghouse Electric Corp.

B. No other manufacturer's products will be considered for installation on this project.

C. Motor and circuit disconnects larger than 200A shall be side hinged.

2.3 FABRICATED SWITCHES

A. General-Duty Disconnect Switches: General duty switches are not acceptable on this project. Only heavy duty switches shall be installed as specified in this section. General duty switches erroneously installed on job shall be replaced with heavy duty switches of type required wherever found.

B. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type, sheet steel enclosed safety switches, of the types, sizes, and electrical characteristics indicated; fusible type, rated for ampacity of circuit and system voltage as a minimum where noted on drawings. Switches shall be of pole configuration required for application with a solid neutral if needed; incorporating quick-make,

quick-break type switches; so constructed that switch blades are visible in "OFF" position with door open. Equip with operating handle which is easily recognizable, and is padlockable in the "OFF" position; construct current carrying parts of positive pressure type reinforced fuse clips. Where noted on the contract documents, provide non-fuse disconnect switches of the same class construction listed above.

C. Provide a double throw Nema 3R disconnect as shown on the plans for connections of a temporary generator.

D. Provide rain-tight switches for outside locations and where noted on the drawings, or where required by code enforcing authorities.

E. Fuses: Provide fuses for safety switches, noted on the drawings or as recommended by the switch manufacturer, of classes, types, and ratings needed to fulfill electrical requirements for service indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR CIRCUIT DISCONNECT SWITCHES

A. Install: Motor and circuit disconnect switches where indicated, complying with the manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of the controller position unless otherwise indicated.

D. Provide nameplates on disconnect switches. Nameplates shall be as required in specification Section 260000.

E. Disconnects installed over the equipment nameplate shall be moved.

3.2 FIELD QUALITY CONTROL

A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION

SECTION 26 3553

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field mounted Surge Protection Devices (SPD).

B. System shall provide temporary overvoltage (TOV) protection and surge protection.

1.2 SUBMITTALS

A. Provide information (include test documentation) confirming compliance with all requirements.

1.3 WARRANTY

A. Manufacturer shall warranty product for (20) years.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. SPD unit shall be UL 1449 Third Edition Listed as type 1 SPD as per drawings.

B. MCOV shall be at least 115% of the nominal system operating voltage.

C. SCCR100 kAIC.

D. Inominal rating 20ka.

E. Enclosure: NEMA 1 with integral disconnect.

2.2 MANUFACTURER

A. Current technology SL3 series with voltage configuration and surge current rating as per drawings.

B. Other manufacturers are invited to submit for prior approval; provide the information required in Section 1.2 SUBMITTALS.

2.3 PRODUCT REQUIREMENTS

A. Monitoring features included.
1. Indicator light which displays protection status.
2. Audible alarm with silence.
3. Form C contacts for remotely monitoring of protection status.
4. Component tracking and visual indication of percent protection remaining.
5. Surge counter which measures and indicates the level of surges.
   a. Low, up to 500 A; Medium, 500 A to 3000 A, High, greater than 3000 A.
6. Time/date stamp, duration and magnitude of the following events.
   a. Sag, swell, surge, voltage drop-outs, power outages, THD, frequency
7. Monitoring information shall be available through the facility network.
8. No software will be required or allowed in order to access information above.
9. Integral Test Point.

B. Performance values (shown on drawings), i.e., shall peak surge current rating and minimum repetitive impulse capacity shall be the values at which the CAPS was tested and survived with less than a 10% degradation in VPR. (Surge current ratings higher than 200 kA/mode will be tested at 200 kA.)

C. For limited and intermediate current TOV (identified in UL 1449 article 39.3 and 39.4) of 30 cycles, the voltage to the MOVs shall be reduced from 173% of nominal voltage to the following values.
1. @30A: 140%; @100A: 150%; @ 500A: 160%; @ 1000A: 160%

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install SPD according to NEC, local electrical codes and manufacturer's instructions.

B. Test SPD with a portable test set to confirm proper wiring and that the suppressed voltage rating, as installed, is within 10% of the suppressed voltage rating value when tested prior to shipment.

END OF SECTION